GORTON

Pantograph

INSTRUCTION BOOK
And PARTS CATALOG

For All Pantograph Engraving Machines

COPY TYPE and MASTERS

also CUTTER GRINDING

GORTON MACHINE CO.

RACINE, WISCONSIN, U.S.A.

SER # 41693

INSTRUCTION BOOK
nd
ATALOG

ograph Machines.

K - 3-B, 3-L - 3-S - 3-K - 3-R.

ering Obsolete Models

H, 1-J, 1-S, 1-T, 3-A, 3-C, 3-D,

I, 3-J, 3-T.

For P13 Ratiobar Pantograph, See Page 53

PLEASE NOTE

Reduction Formula and Area Chart for 3-S Pantograph also apply to the P3-2 Pantomill.

Reduction Formula and Area Chart for 3-L Pantograph also apply to the P2-3 Pantomill.

George Gorton Machine Co., Racine, Wis.

Form 3016.

CONTENTS

GUARANTY

The George Gorton Machine Co., agrees to remedy any condition caused by faulty workmanship or materials in products of its manufacture, by repairing and/or replacing defective parts up to one year from date of shipment direct to customer or to dealer for reshipment to customer, provided that the machine, tooling or other equipment covered by this guaranty is still in the possession of the original purchaser and has not (in the opinion of the George Gorton Machine Co.) been abused or misused. This guaranty supersedes and replaces any and all other guaranties or warranties, either expressed or implied, and is limited by the foregoing statement.

George Gorton Machine Co., Racine, Wisconsin, U.S.A.

Form 1385-E

SER # 41693

TRUCTION BOOK
and
PARTS CATALOG

For Gorton Pantograph Machines.

Models 3-U, 3-F - 3-Z, 3-X - 3-B, 3-L - 3-S - 3-K - 3-R.

Also Parts List Covering Obsolete Models

, 1-A, 1-C, 1-D, 1-G, 1-H, 1-J, 1-S, 1-T, 3-A, 3-C, 3-D, 3-G, 3-H, 3-J, 3-T.

For P13 Ratiobar Pantograph, See Page 53

CONTENTS

Price per copy $2.50

GEORGE GORTON MACHINE CO.

RACINE, WISCONSIN, U. S. A.

Form 1385-E

REG. U.S. PAT. OFF. TRADE MARK
GORTON
RACINE, WIS., U.S.A.

Installation and Erection

FOR ALL GORTON PANTOGRAPH ENGRAVING MACHINES

1. UNPACKING

Examine the box in which the machine is received to see that it is intact and that the machine has not been damaged in transit. All Gorton machines are shipped *boxed tight*, not crated, to eliminate dust or cinders and to prevent anything being thrust through the spaces of a crate to damage the machine. After removing box, check up all parts with the packing list. Carefully examine all packing paper and excelsior to make sure that no small parts have been overlooked.

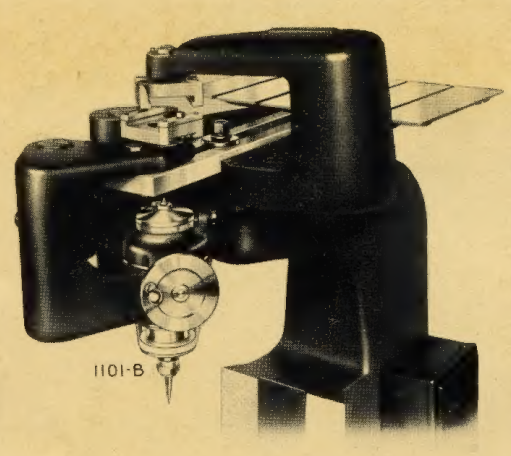

Fig. 1—Cutter Head Locked for Shipping

2. CLEANING

Kerosene is preferable for use in cleaning the machine. Using rags free from lint, and fresh kerosene, wipe the entire machine thoroughly, immersing smaller parts. Be especially careful not to immerse the Pantograph or soak felt seals in any way, as this will result in damage to them.

3. LOCATING THE MACHINE

All machines are assembled complete in two units, the base and the Pantograph. Before installing the Pantograph, locate the machine base in desirable position, centered in front of a good window light, with operator's left side to the window. Daylight is preferable when conditions permit, although good indirect artificial lighting affords satisfactory operating conditions. Machine lamps are available to insure maximum visibility.

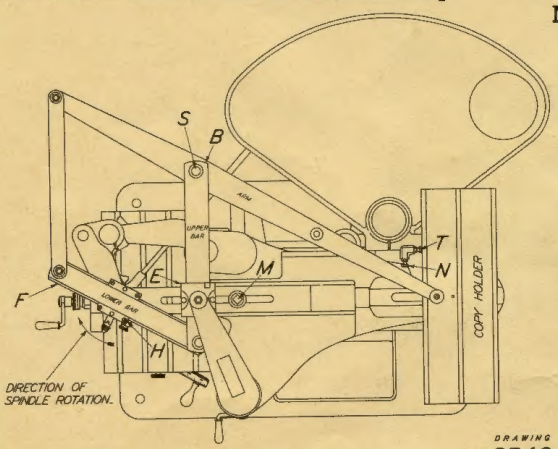

Fig. 2—Top View of Machine with Assembly Reference Points

4. LEVELING

A flat, solid floor is of primary importance. Place a small machinist level on the machine table. Shim up base to proper level as required. Although base is drilled for lag screws used in shipping, anchor bolts to floor may be used for greater solidarity. Should the floor transmit too much vibration from surrounding machinery, good practice is to set machine on rubber or cork pads, or equivalent.

5. SETTING THE SLIDER HEAD (See ★ below)

With the wrench provided, loosen bolt "M" which clamps the Forming and Routing attachment to the slider head. The front end can then be pushed down (or gently pried and tapped with wood block) releasing the hinged cutter head and link. This cutter head and link is also held in the shipping position when it is desired to operate machine as a vertical miller or router with a fixed spindle. (Instructions for converting the Pantograph into a router are engraved on former bar.) Now, with bolt "M" loosened, move the slider head to the position indicating, on the graduated scale at right side of head, the scale of reduction to be used. Then clamp bolt firmly. This setting of slider head need only be approximate without affecting accuracy of the machine.

6. PUTTING THE PANTOGRAPH IN PLACE (See ★ below)

Now, holding Pantograph in position shown below, place SLIDER BAR "F" in SLIDER BLOCK "H," with index spot to the front. Then insert SLIDER BAR "B" in SLIDER BLOCK "E" with index spot toward "S," making sure gib cap screws (365-L, Drwg. 9342, Page 8) are loosened. Take care that edges of blocks and bars are not dented or battered in this operation. These parts are carefully fitted and no force is necessary to slip the bars into the blocks, if started properly. After setting to the desired reduction and locking the bars in the blocks by means of the hexagon cap screws in each block, the machine is ready for use.

★ NOTE—Above paragraphs 5 and 6 do not apply to Models 3-B, 3-L and 3-S, as they have integral fixed heads and are shipped with Pantographs mounted in place.

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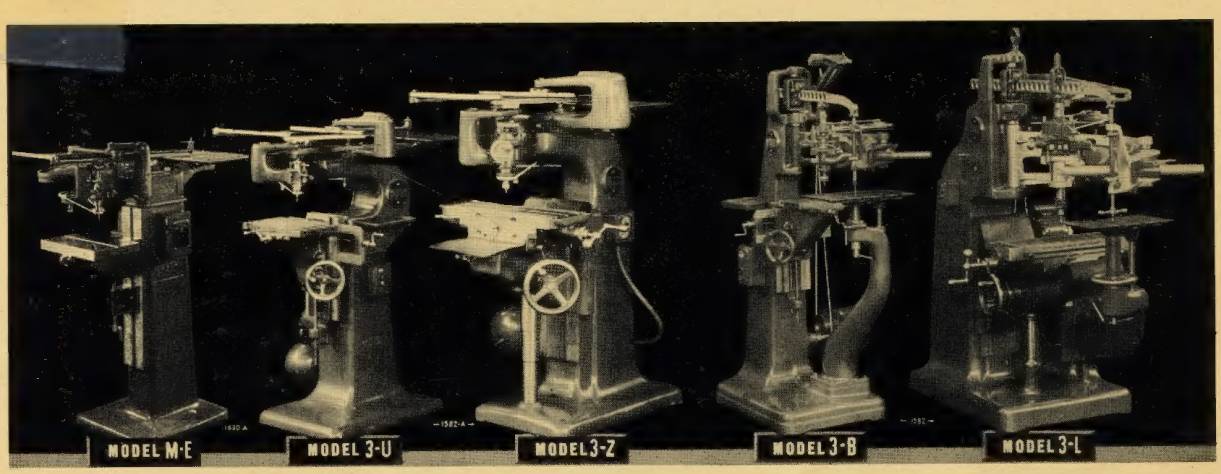
GORTON
RACINE, WIS., U.S.A.

Proper Lubrication

FOR ALL GORTON PANTOGRAPH ENGRAVING MACHINES



Correct Oils and Greases FOR EFFICIENT PERFORMANCE

Thorough research and tests have proven oils and greases recommended herein give maximum operating efficiency of Gorton units. Only high quality oils and greases should be used.

HIGH SPEED SPINDLE

For lubricating the high speed spindle, use a pure mineral oil, such as Gargoyle Velocite Oil S or equivalent, with viscosity rating of approximately 80 seconds S. U. at 100° F. Avoid using gum-forming household types of oils, which may cause bearing failure from gum deposits within the bearings.

OIL HOLES AND OIL CUPS

For all other oil holes and oil cups, use a medium machine oil such as Gargoyle Vactra Oil Heavy Medium X.

ELECTRIC MOTORS

Lubricate sleeve bearing motors with a high grade, medium bodied bearing lubricant such as Gargoyle Etna Oil Heavy Medium. A few drops every 1000 hours is sufficient. Use Gargoyle BRB No. 2 for ball bearing motors. Fill with this grease every 1000 hours.

GREASE CUPS AND PANTOGRAPH BEARINGS

Use a high grade ball bearing grease of medium consistency equivalent to Gargoyle grease BRB No. 2. Be sure grease cup is cleaned with rag, before removing to refill.

GENERAL LUBRICATING SCHEDULE

(See individual drawings for specific instructions.)

SIMPLIFIED LUBRICATION SYMBOLS

For the purpose of uniformity and simplification, the following system of symbols are used throughout on all assembly and parts drawings, thus —

LUBRICATION SCHEDULE
⊗ Use spindle oil twice a day.
⊠ Oil once a week.
● Machine oil once a month.
●— Fill with grease once a year.
■ One turn of grease cup a week.
◘ Fill with grease every 1000 hours.
○ Fill with grease once every 2 years.

REMEMBER

Fine Precision Machine Tools deserve fine care. At the extremely high speeds at which these machines run, proper application of the correct grades of lubricants, as prescribed above, is essential. To maintain maximum operating efficiency and smooth precision performance, rigidly follow the Lubrication Schedule recommended for your machine.

REG U.S. PAT. OFF. TRADE MARK GORTON RACINE, WIS., U.S.A.

M-E Munitions Engraving Machine

INSTALLATION, LUBRICATION and ADJUSTMENT

UNPACKING and ERECTING

Follow instructions as outlined on page 3.

LUBRICATION SCHEDULE

Read first, Lubrication Instructions, page 4, then, using oils and greases recommended, proceed as follows:

⊗ Oil twice a day

Cutter head link pivot bearings. Use mineral type of spindle oil at ⊗ page 6, for Cutter Spindle.

■ Once a week

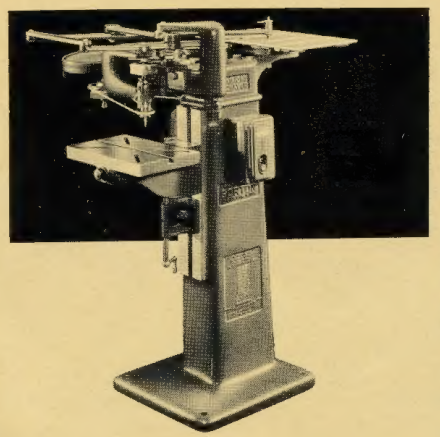
All other oil holes and cups. Grease drive pulley ■ by giving one turn to grease cup 7001 "GA".

□ Grease every 1000 hours

Inspect and repack motor ball bearing, if necessary, using Gargoyle grease BRB No. 2

◆ Grease once a year

Remove the two 5/16" hexagon half nuts ◆ at ends of Pantograph link 11322 and repack bearings.



M-E Machine

THE PANTOGRAPH

To assemble Pantograph on machine as shown on Drawing 11401 (opposite page) — first connect to Cutter Head, then to supporting arm of Pantograph by inserting studs 11323 in respective holes. Adjust Pantograph for proper alignment by slightly raising or lowering entire connection in Cutter Head. Firmly tighten cap screw 365-A-E at top of Cutter Head.

OPERATION

The Pantograph transmits movement from tracer point to work at 3:1 or 6:1 reduction, whichever machine is ordered.

FOR FLAT WORK ONLY — (See assembly 11402 below.) Tracer point is guided by hand around outline of copy, type or template secured on the copy holder.

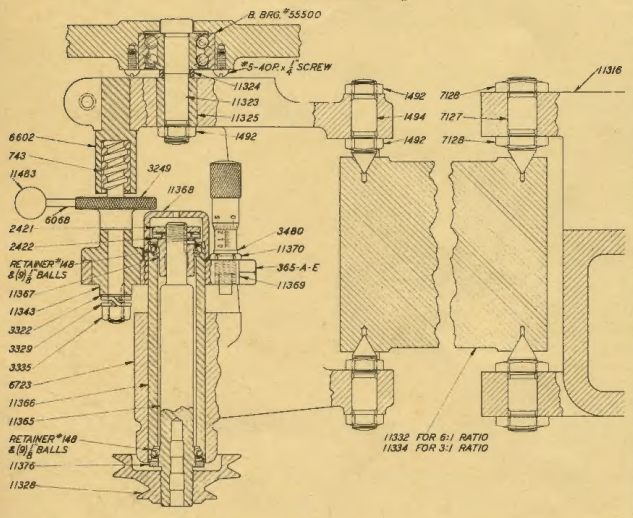
FOR CURVED OR FLAT WORK — (See assembly 11407 below.) For Flat Work tighten cap screw 366-M in spindle feed works. For Curved Work, loosen it so spindle is free to float. Desired curvature is obtained by use of forming guides. See Page 27.

GENERAL CARE

Model M-E should be thoroughly cleaned at least once a week and scraped ways wiped clean and oiled.

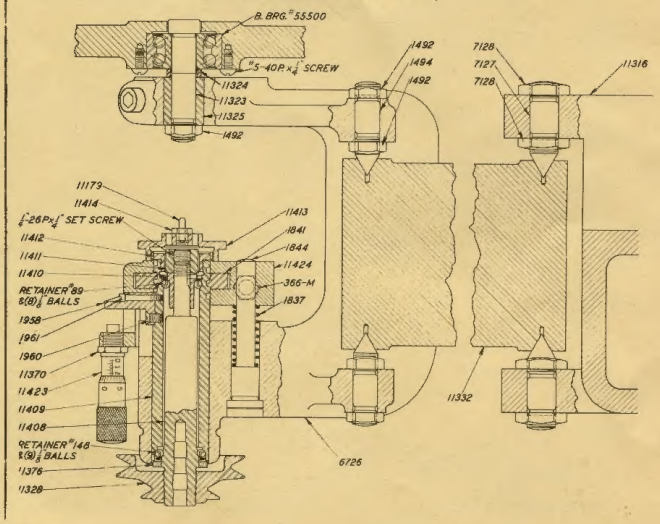
SINGLE PURPOSE Cutter Head Assembly 11402

(For Flat Work Only)



DOUBLE PURPOSE Cutter Head Assembly 11407

(For Flat and Curved Work)



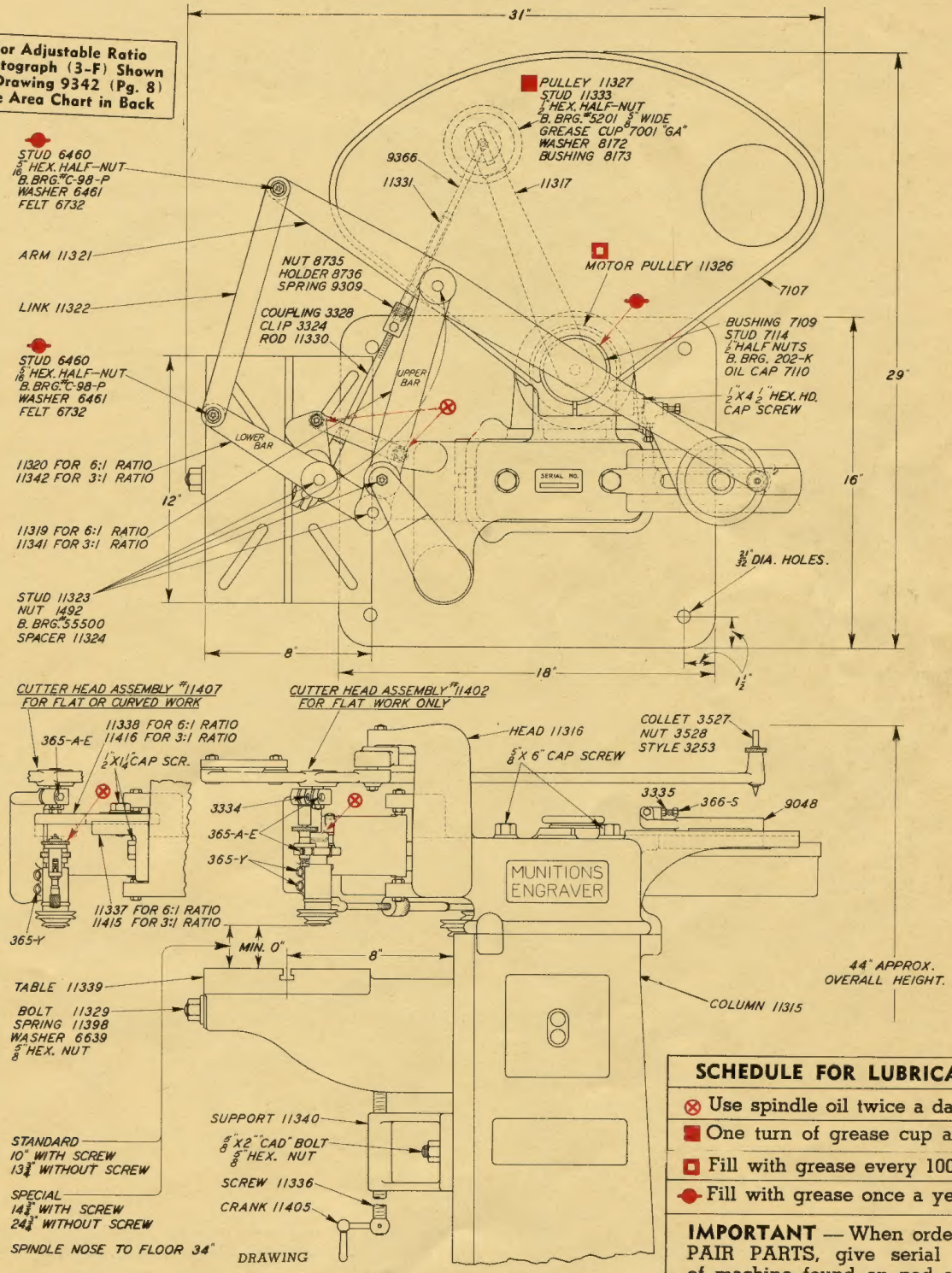
Areas covered at one setting shown actual size at rear of this book. Accessories for use with this machine in Gorton Accessories Catalog. Copy for use with these machines in Gorton Master Copy-Type Catalog.

M-E Munitions Engraving Machine

PANTOGRAPH ASSEMBLY and PARTS DRAWING

For 3:1 or 6:1 Fixed Ratio Pantograph

For Adjustable Ratio Pantograph (3-F) Shown on Drawing 9342 (Pg. 8) See Area Chart in Back



DRAWING
11401

SCHEDULE FOR LUBRICATION

⊗	Use spindle oil twice a day.
■	One turn of grease cup a week.
□	Fill with grease every 1000 hrs.
●	Fill with grease once a year.

IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.

3-U (and 3-F) Machines
INSTALLATION, LUBRICATION and ADJUSTMENT

UNPACKING and ERECTING

Follow instructions as outlined on page 3.

LUBRICATION SCHEDULE

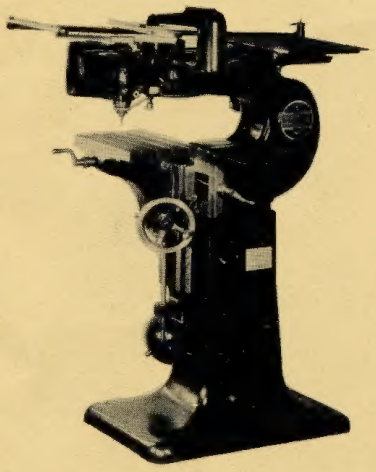
Read first, Lubrication Instructions page 4, then, using oils and greases recommended, proceed as follows:

⊗ Oil twice a day

Use mineral type spindle oil at holes "A" and "B" for Cutter Spindle, page 9. Use medium oil on guide pulley oil cups "C" and "D", page 8.

■ Once a week

All other oil holes and oil cups. (Remember to replace oil hole plugs.) Run work table out to extreme position and squirt a few drops of oil on table and saddle screws. Give one turn to drive pulley stud grease cup "E", page 8.



3-U Machine

● Oil once a month

Lubricate motor oilers with a few drops of medium machine oil such as Gargoyle Etna Oil Heavy. Avoid excessive oiling which results in arcing and damaged motor windings. (For Sleeve Bearing Motors.)

● Grease once a year

Remove grease plugs "F" on cutter head link, page 8, and fill, using a grease cup or gun. Remove Pantograph assembly, then remove all upper polished dust washers No. 6943-A, page 8, which cover Pantograph bearings, by inserting a thin knife blade in the washer slot. Also repack bearings in upper and lower blocks (No. 224-A and No. 226-A). Repack bearings with bearing grease or vaseline, preferably Gargoyle No. 2 BRB, packing tightly so as to force a new supply into the lower bearing. Snap dust washers back into place. Remove nuts 3336-A page 8, holding Pantograph link and repack these bearings. Remove cap 7110-A page 8, repack chamber with cup grease. For Ball Bearings Motors, check motor journals and repack with grease if necessary.

THE CUTTER SPINDLE

Spindle bearings are not manually adjustable, but automatically take up normal wear. Proper lubrication will prevent excessive wear and increase operating efficiency. The spindle is quickly removable; and, should repair or replacement be necessary, we suggest spindle be returned to us for overhaul, which will be done promptly at a nominal cost. This will make the spindle as accurate as new.

To remove cutter spindle, first remove belt, and push feed lever (8732-A, page 9) to left, disengage lock pin (8702-A, page 9) in center of cutter head, and swing back spring bolt (8707-A, page 8) on right of cutter head. Then hold cutter spindle pulley with right hand, and with left hand swing front half of cutter head out of place and lift spindle free.

THE PANTOGRAPH

Pantograph requires care only in proper greasing as per lubrication schedule on page 8. If play develops in the ball bearing joints after several years' use, it can easily be adjusted by gently tightening the three nuts 3336-A and nut 1492-A, page 8. Excessive tightening may cause the balls to cut into the cups, causing loss of sensitivity, unnecessary wear and inaccuracy. Tighten these very slightly. Before adjusting nut, loosen cap screw 365-A-E on cutter head, page 8, to allow Pantograph to align itself properly. Then remove Pantograph entirely, swing cutter head out of the way and test the Pantograph blocks 224-A, 226-A page 8, for freedom of rotation without play, attached to slider head only. Finally tighten nut on these links, working arms to "feel" when play is removed so that links move rigidly without binding.

THE CUTTER HEAD LINK

Cutter head link bearings require care only in proper attention to greasing. If, after several years' use, these become a trifle loose, they can be taken up by loosening slightly (not entirely) the cap screws "G", page 9, and tapping downward against the top of the plug 8713-A or 8714-A. After tapping into position, tighten cap screws "G". This adjustment may rarely, if ever, be necessary. For any other adjustments required consult our Engineering Department.

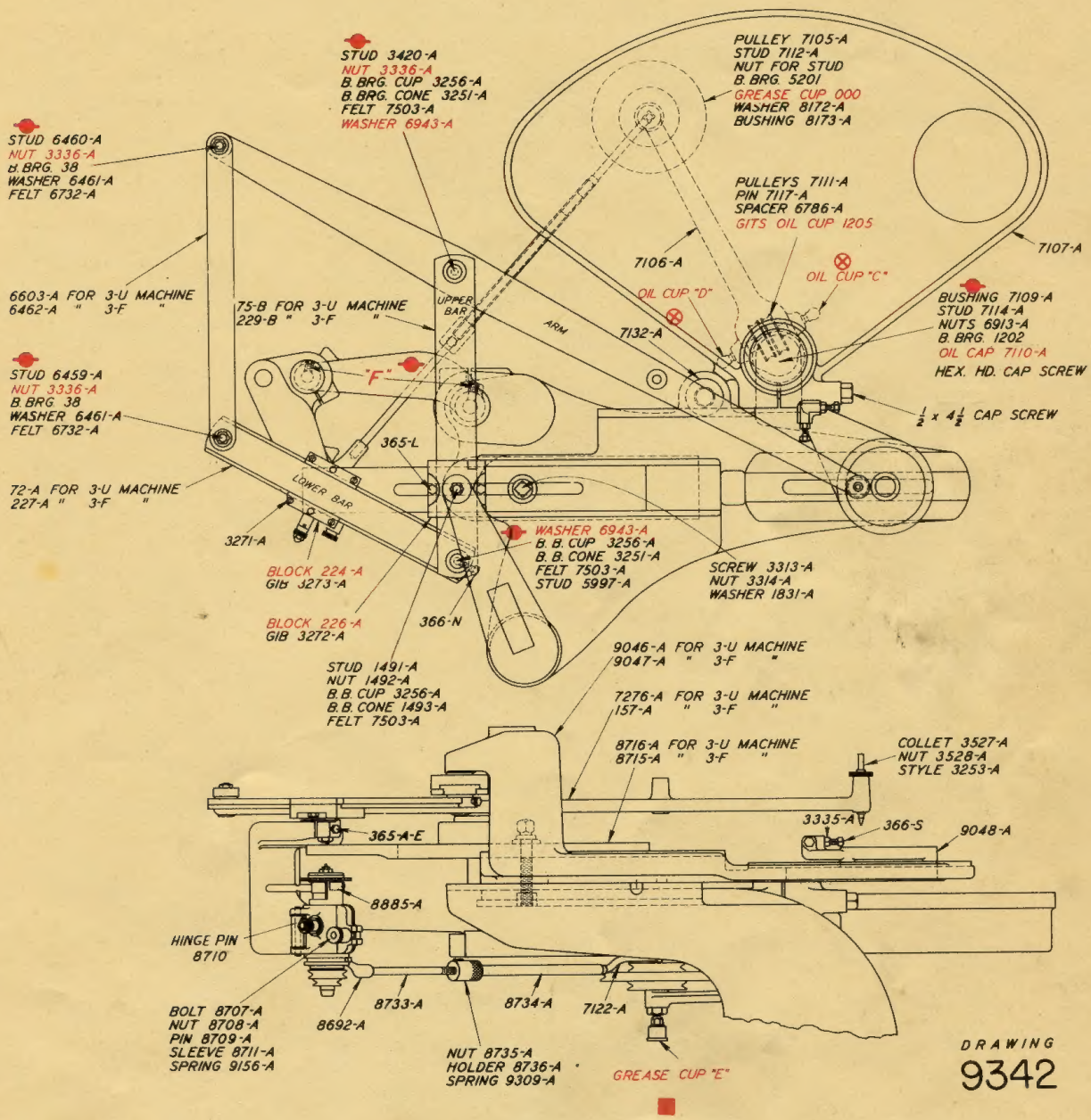
GENERAL CARE

The machines should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Mechanical specifications and complete description in Gorton-Pantograph Engraving Machine Bulletin. Areas covered at one setting shown actual size at rear of this book. Accessories for use with these machines in Gorton Accessories Catalog. Copy for use with these machines in Gorton Master Copy-Type Catalog.

3-U (and 3-F) Machines

PANTOGRAPH ASSEMBLY and PARTS DRAWING



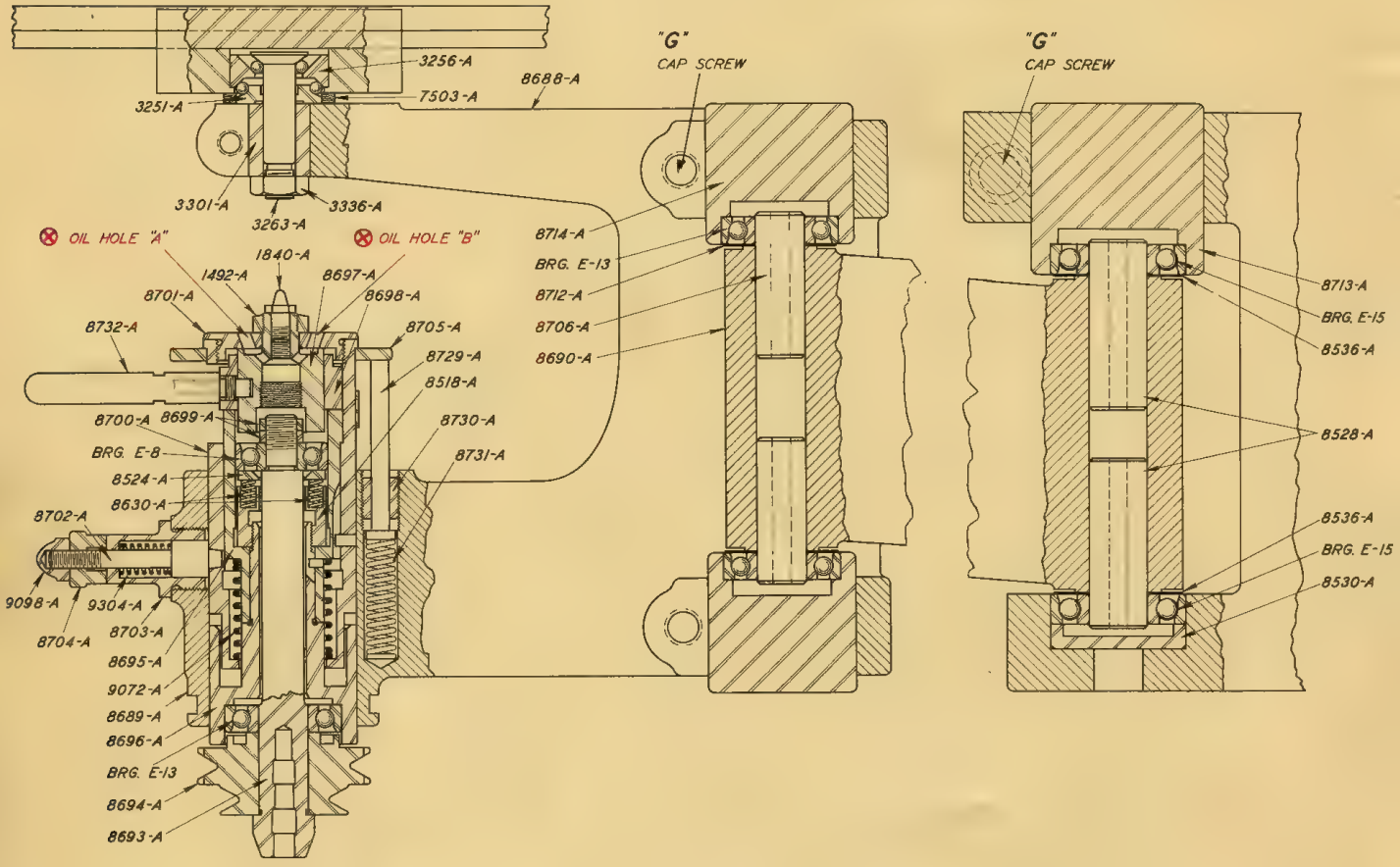
DRAWING
9342

IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.	**SCHEDULE FOR LUBRICATION**
	⊗ Use spindle oil twice a day.
	■ One turn of grease cup a week.
	● Fill with grease once a year.

(Continued on next page)

3-U (and 3-F) Machines (Continued)

CUTTER HEAD ASSEMBLY and PARTS DRAWING



DRAWING
9341

SCHEDULE FOR LUBRICATION
⊗ Use spindle oil twice a day.

REPAIR PARTS

IMPORTANT

When ordering repairs parts, give serial number of machine found on pad at top of slider head.

3-Z (and 3-X) Machines
INSTALLATION, LUBRICATION and ADJUSTMENT

UNPACKING and ERECTING

Follow instructions as outlined on page 3.

LUBRICATION SCHEDULE

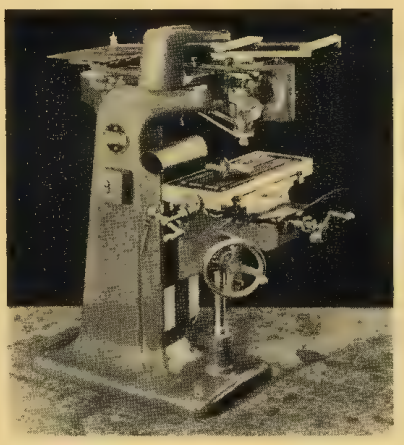
Read first Lubrication Instructions, page 4; then, using oils and greases recommended, proceed as follows:

⊗ Oil twice a day

Use mineral type spindle oil at holes "C" and "D", page 12, for Cutter Spindle. Use medium oil on guide pulley oil cups 1205, page 11; also at oil cup 301, on page 12.

⊠ ■ Once a week

All other oil holes and oil cups. (Remember to replace oil hole plugs.) Run work table out to extreme position and squirt a few drops of oil on table and saddle screws. Lift the knee elevating screw shield and squirt a few drops of oil on screw. Give one turn to drive pulley stud grease cup 00, and cutter head link grease cup 00, page 11.



3-Z Machine

● Grease once a year

Remove the polished dust washers 6795-A, page 11, covering Pantograph bearing, by inserting a thin knife blade in the washer slot. Repack bearings in Pantograph and Pantograph blocks with bearing grease, preferably Gargoyle BRB No. 2, packing tightly so as to force a new supply into the lower bearing. Snap dust washers back into place. Remove nuts 6208-A page 11, holding Pantograph link and repack bearings as above. Remove cap 7110-A, page 11, and repack chamber with cup grease, Gargoyle BRB No. 2 or equal. Inspect the ball bearing grease-packed motor journals and repack if necessary.

THE CUTTER SPINDLE

Spindle Bearings are not manually adjustable, but automatically take up normal wear. After several years, the spindle may become inaccurate through ball bearing wear. If repair or replacement is necessary, we suggest returning spindle to us for overhaul which will be done promptly at a nominal cost. This will make the spindle as accurate as new.

Avoid using cutters more than one or two thousandths undersize. Undersize cutters require excessive tightening of collet nut to prevent cutter slippage, thus permanently springing the spindle, causing the cutters to run out of true.

OPERATING ADJUSTMENTS

On machines equipped with REMOVABLE SPINDLE 698-1, top of page 12, the same instructions and cautions apply as above, with this addition: When spindle is removed, prevent small chips and grinding dust from lodging around top seal. When replacing, thoroughly clean outside surface of spindle.

THE PANTOGRAPH

Pantograph requires care only in proper greasing as per lubricating schedule. If play develops in the ball bearing joints after several years' use, it can be removed by tightening nuts on all Pantograph studs, pages 11 and 12. Avoid excessive tightening which results in balls cutting into cups, causing wear and inaccuracy. Before tightening nut, loosen hexagon cap screw "E" on cutter head, page 11, to allow Pantograph to realign itself properly. Then re-tighten screw "E."

THE CUTTER HEAD LINK

Cutter head link bearings should not require attention other than greasing. If, after several years, these become a trifle loose, they can be taken up by loosening slightly (not entirely) the set screws "F," page 12, and tightening slotted head adjusting screws 6359-A, page 12. Then re-tighten screws "F."

TABLE GIBS

Table gibs are tapered with adjusting screw at one end of gib and locking screw at other end. To tighten gib, loosen locking screw at small end adjusting the screw at opposite end as required. The knee gib has a tapered side and can be adjusted simply by tightening the gib screws.

GENERAL CARE

The machine should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Mechanical specifications and complete description in Gorton-Pantograph Engraving Machine Bulletin. Areas covered at one setting shown actual size at rear of this book. Accessories for use with these machines in Gorton Accessories Catalog. Copy for use with these machines in Gorton Master Copy-Type Catalog.

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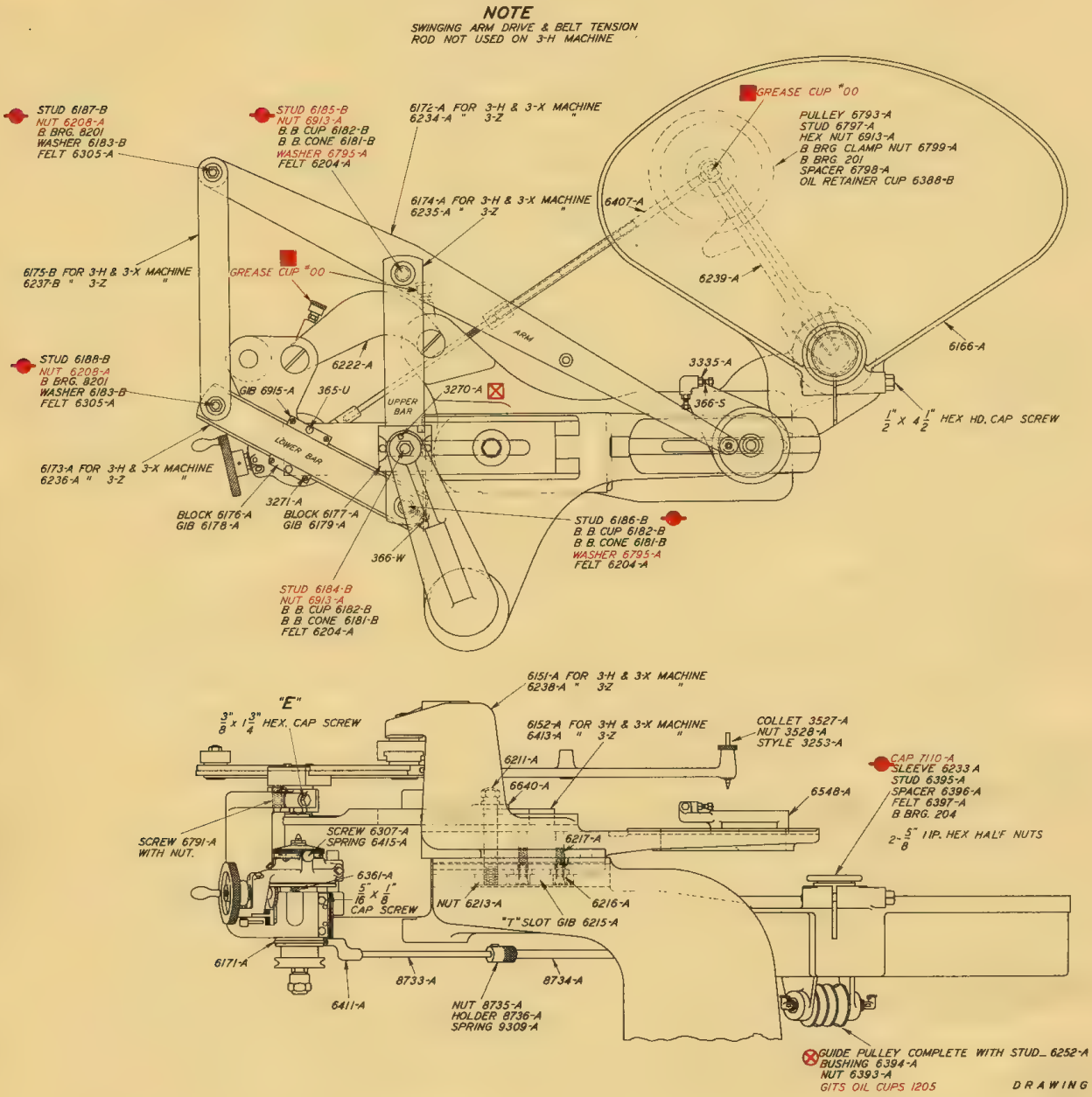
3-Z (and 3-X) Machines

PANTOGRAPH ASSEMBLY and PARTS DRAWING



DRAWING
9344

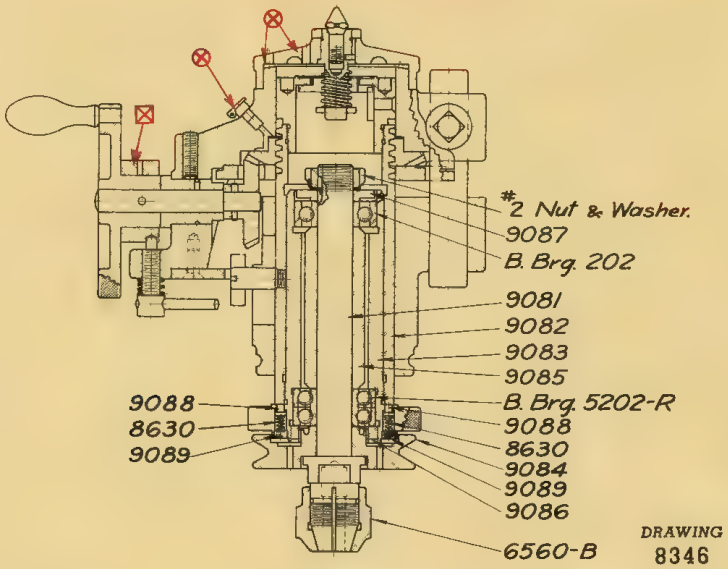
IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.

SCHEDULE FOR LUBRICATION	
⊗	Use spindle oil twice a day.
☒	Oil once a week.
■	One turn of grease cup a week.
●	Fill with grease once a year.

3-Z (and 3-X) Machines

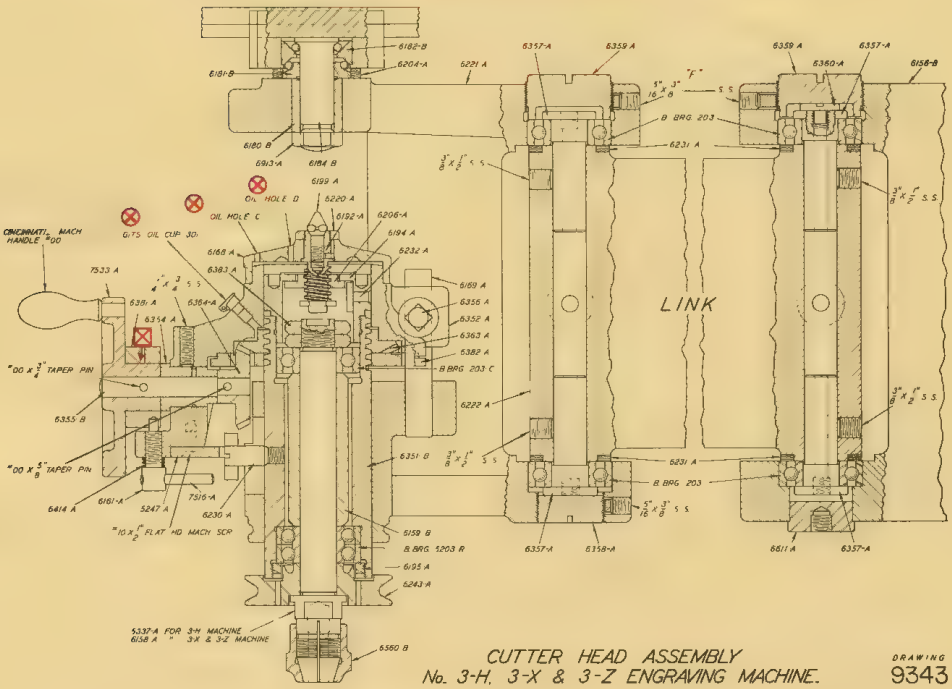
CUTTER HEAD ASSEMBLY and PARTS DRAWING

698-1 REMOVABLE SPINDLE



DRAWING 8346

NON-REMOVABLE SPINDLE



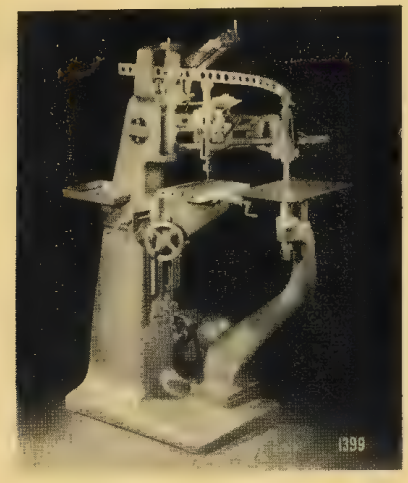
CUTTER HEAD ASSEMBLY
No. 3-H, 3-X & 3-Z ENGRAVING MACHINE.

DRAWING 9343

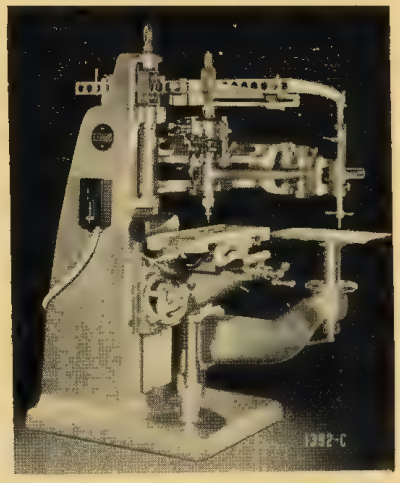
IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.	SCHEDULE FOR LUBRICATION
	⊗ Use spindle oil twice a day.
	⊠ Oil once a week.

3-B, 3-L (3-Dimensional) Machines

INSTALLATION, LUBRICATION and ADJUSTMENT



3-B Machine



3-L Machine

UNPACKING and ERECTING

Follow instructions as outlined on page 3. However, 3-B and 3-L machines are shipped with Pantograph completely assembled. Pantograph is securely fastened during shipment by special casting, fitted around the cutter spindle and bolted to machine table. Loosen bolts and remove casting. Place belts on drive mechanism, position and adjust belt tension rod. Then set the Pantograph, slip in and lock modeling bar, and machine is ready to operate.

LUBRICATION SCHEDULE

Read first, Lubrication Instructions, page 4; then, using oils and greases recommended, proceed as follows:

⊗ Oil twice a day

Use mineral type spindle oil at holes ⊗ pages 14, 16, for Cutter spindle. Medium oil on idler pulleys.

⊠ ■ Once a week

All other oil holes and cups. (Remember to replace oil hole plugs.) Run work table out to extreme position and squirt a few drops of oil on table and saddle screws. Give all grease cups one turn. Lift the knee elevating screw cover and squirt a few drops of oil on screw (uncovered on 3-B). Wipe all polished Pantograph surfaces with oily rag to prevent rust.

● Oil once a month

Lubricate motor oilers with a few drops of medium oil such as Gargoyle Etna Oil Heavy. Avoid excessive oiling which results in arcing and damaged motor windings.

⊷ Grease once a year

Remove cap corresponding to ⊷7110-A, page 11, covering idler pulley pivot stud and repack chamber with grease. If ball bearing motor, inspect and add grease if necessary.

○ Grease once every two years

Remove the ⅛ inch slotted pipe plugs at top and bottom of every Pantograph pivot joint, and by inserting grease cup, grease gun, or fitting and gun, fill with new grease until the old oozes out around the sides of seals.

THE CUTTER SPINDLE

Spindle bearings are not manually adjustable, but automatically take up normal wear. Proper lubrication will prevent excessive wear and increase operation efficiency. Should repair or replacement be necessary, we suggest spindle be returned to us for overhaul, which will be done promptly at a nominal cost. This will make the spindle as accurate as new.

To remove the 3-L spindle, turn to left and unscrew. When spindle is removed, prevent small chips and grinding dust from lodging around seal. When replacing, thoroughly wipe off the outside surface of spindle.

TABLE GIBS

Table gibs are tapered with adjusting screw at both ends. To tighten gib, loosen screw at small end, tightening the screw at opposite end as required. The knee gib has a tapered side and can be adjusted simply by tightening the gib screws.

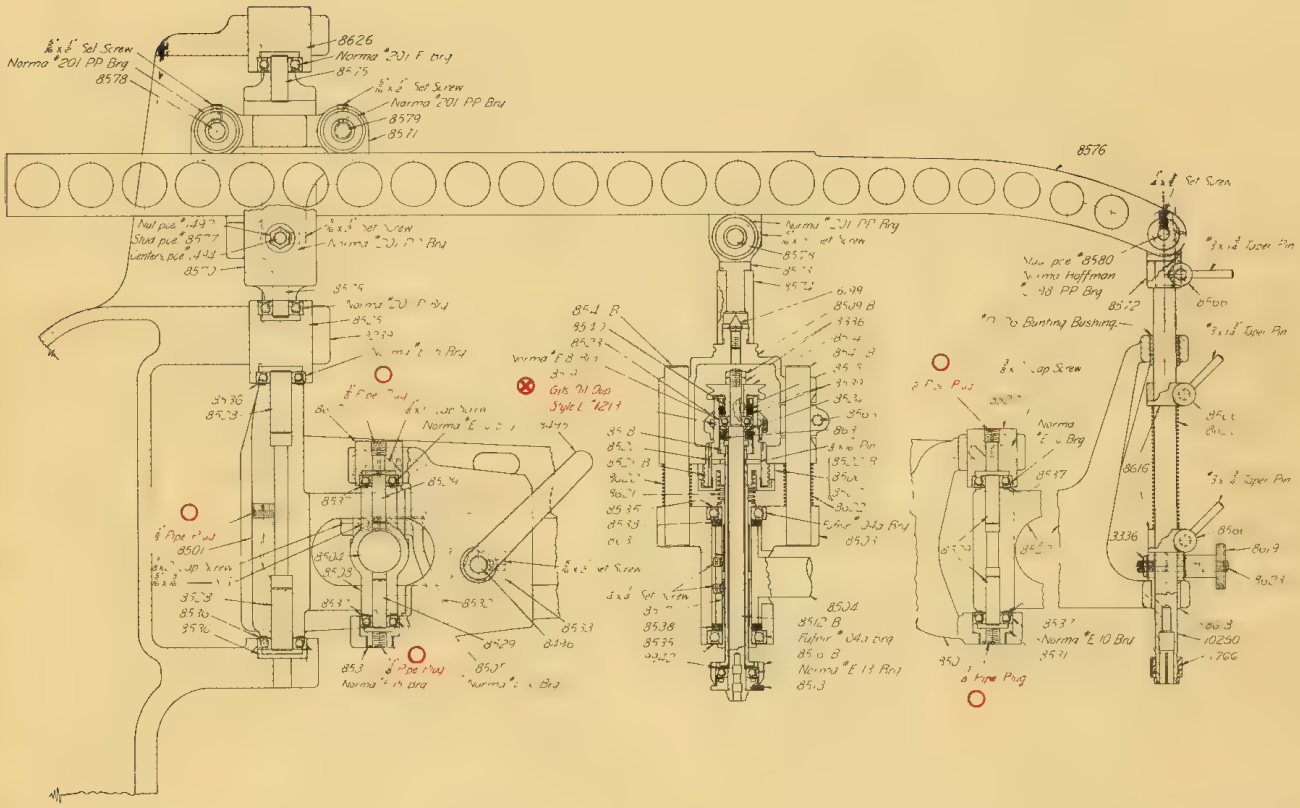
GENERAL CARE

The machine should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Mechanical specifications and complete description in Gorton-Pantograph Engraving Machine Bulletin. Areas covered at one setting shown half size at back of this book. Reduction formula and schedules on page . . . Accessories for use with these machines in Gorton Accessories Catalog. Copy for use with these machines in Gorton Master Copy-Type Catalog.

3-B (3-Dimensional) Machine

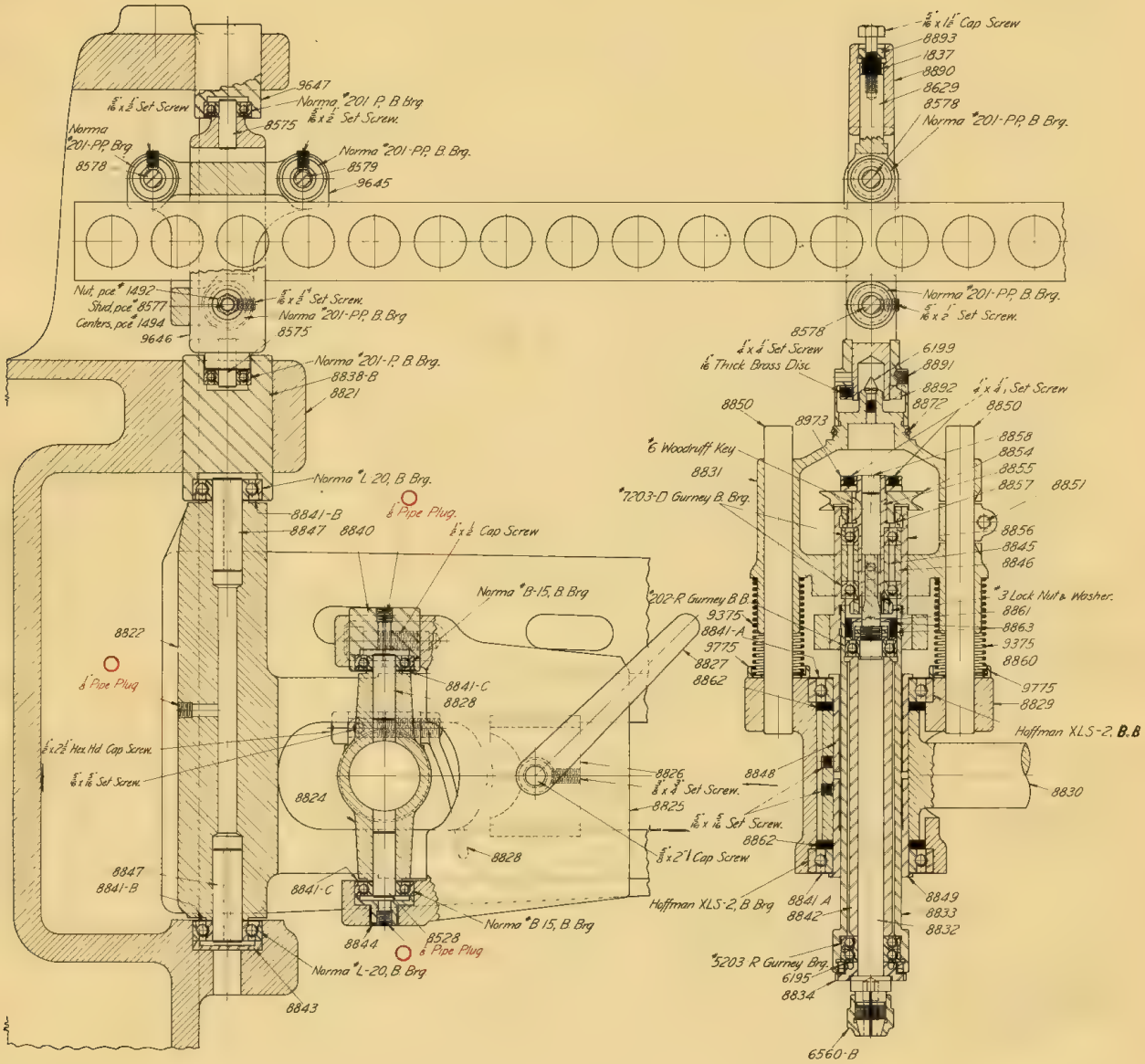
PANTOGRAPH and CUTTER HEAD ASSEMBLY, and PARTS DRAWING



DRAWING
9947

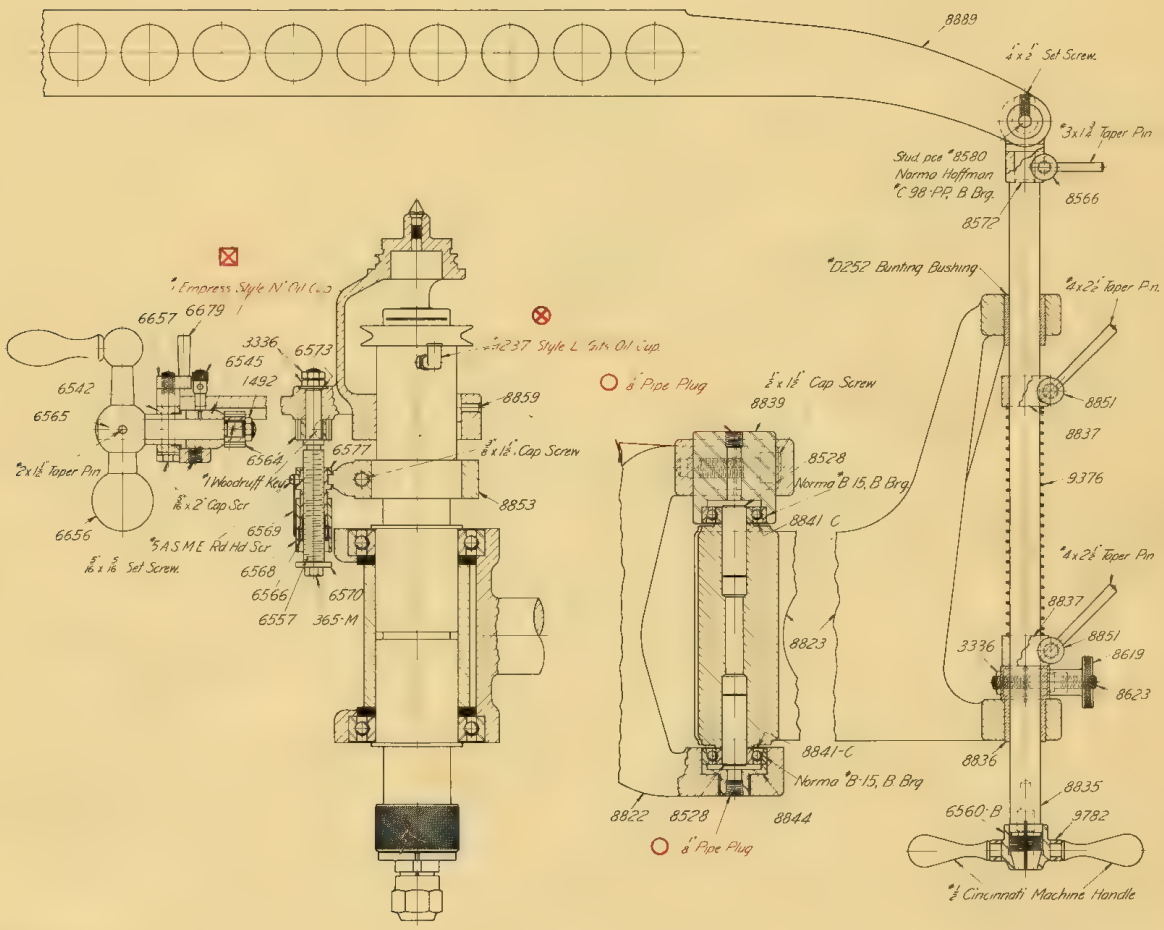
IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.	**SCHEDULE FOR LUBRICATION**
	⊗ Use spindle oil twice a day.
	○ Fill with grease once every 2 years.

3-L (3-Dimensional) Machine —



FOR ENLARGING SPINDLE 804-1 ASSEMBLY and PARTS DRAWING
See Page 47

PANTOGRAPH and CUTTER HEAD ASSEMBLY, and PARTS DRAWING



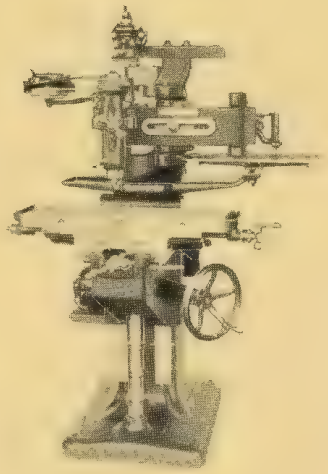
DRAWING
9900

IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.	**SCHEDULE FOR LUBRICATION**
	⊗ Use spindle oil twice a day.
	⊠ Oil once a week.
	○ Fill with grease once every 2 years.

3-S (and 1-S) Machine*
INSTALLATION, LUBRICATION and ADJUSTMENT

UNPACKING and ERECTING

Follow instructions as outlined on page 3, however, 3-S machines are shipped with Pantograph completely assembled, except for export when Pantograph is disassembled and packed separately. Pantograph is securely fastened during shipment by special casting, fitted around the cutter spindle and bolted to machine table. Loosen bolts and remove the casting. Place belts on drive mechanism, position and adjust belt tension rod. Set the Pantograph, and machine is ready to operate.



THE CUTTER SPINDLE

Spindle bearings are not manually adjustable, but automatically take up normal wear. Proper lubrication will prevent excessive wear and increase operation efficiency. Should repair or replacement be necessary we suggest spindle be returned to us for overhaul which will be done promptly at a nominal cost. This will make the spindle as accurate as new. (When replacing spindle, care should be taken to prevent small chips and grinding dust from lodging around seal.)

LUBRICATION SCHEDULE

Read first, Lubrication Instructions, page 4; then, using oils and greases recommended, proceed as follows:

Oil twice a day

All other oil holes and cups (remember to replace oil hole plugs). Run work table out to extreme position, and squirt a few drops of oil on table and saddle screws.

Once a week

Lift knee elevating screw cover, and squirt a few drops of oil on screw. Give all grease cups one turn and Alemite fittings one shot.

Grease once a year

Remove cap corresponding to 7110-A, page 11. Inspect the ball bearing grease-packed motor journals and repack, if necessary.

TABLE GIBS

Table gibs are tapered with adjusting screw at one end and locking screw at other end. To tighten gib, loosen locking screw at one end, tightening the screw at opposite end as required. Knee gib has a tapered side and is also easily adjustable.

GENERAL CARE

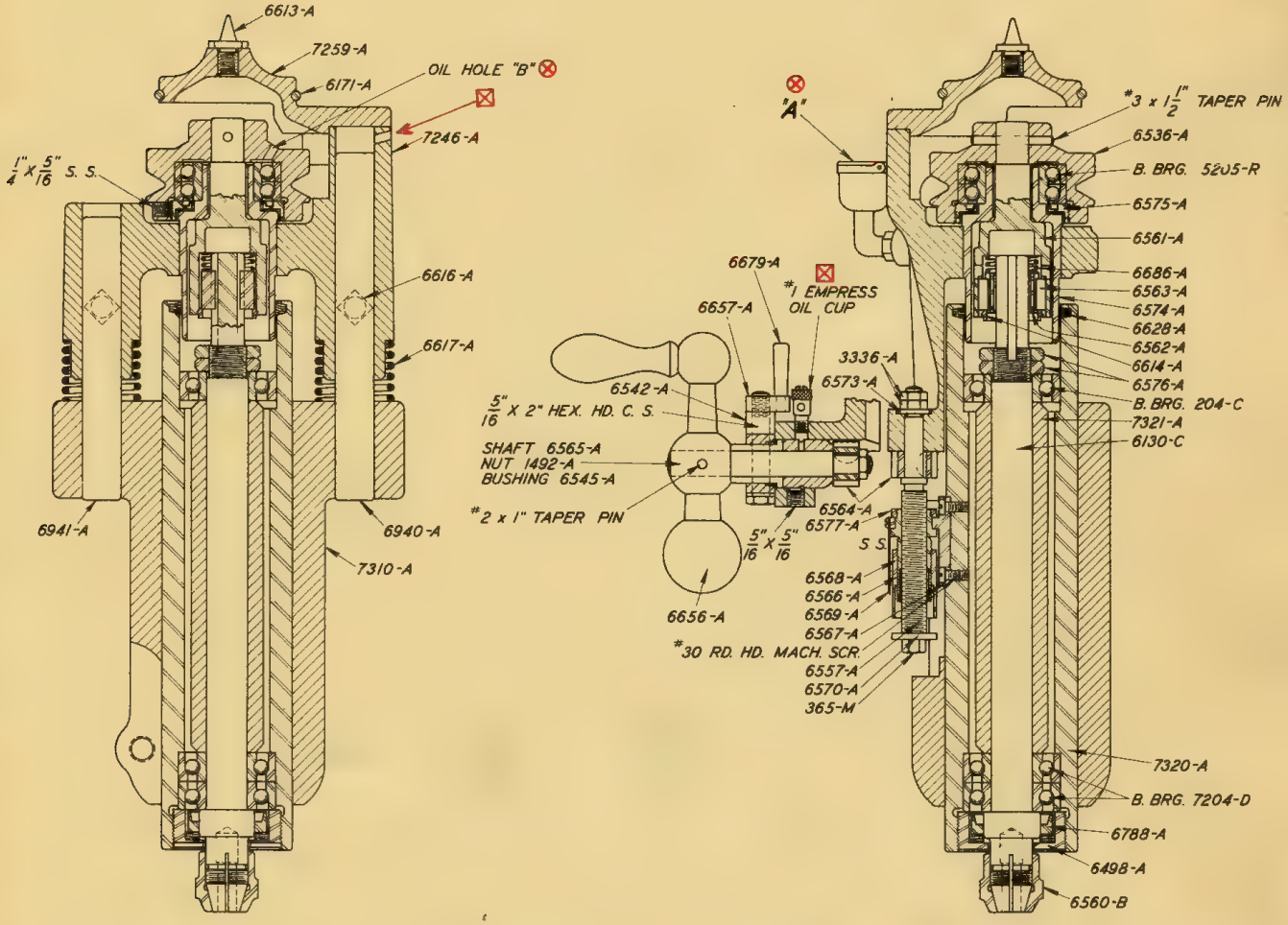
The machine should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

* NOTE: All instructions on this page also apply to model 1-S machines, now obsolete. The improvement in design has not altered construction or operation of any essential parts of the machine.

Mechanical specifications and complete description in Gorton-Pantograph Engraving Machine Bulletin. Areas covered at one setting shown actual size at rear of this book. Accessories for use with these machines in Gorton Accessories Catalog. Copy for use with these machines in Gorton Master Copy-Type Catalog.

3-S Machine

CUTTER HEAD ASSEMBLY and PARTS DRAWING



DRAWING
9345

SCHEDULE FOR LUBRICATION
⊗ Use spindle oil twice a day.
⊠ Oil once a week.

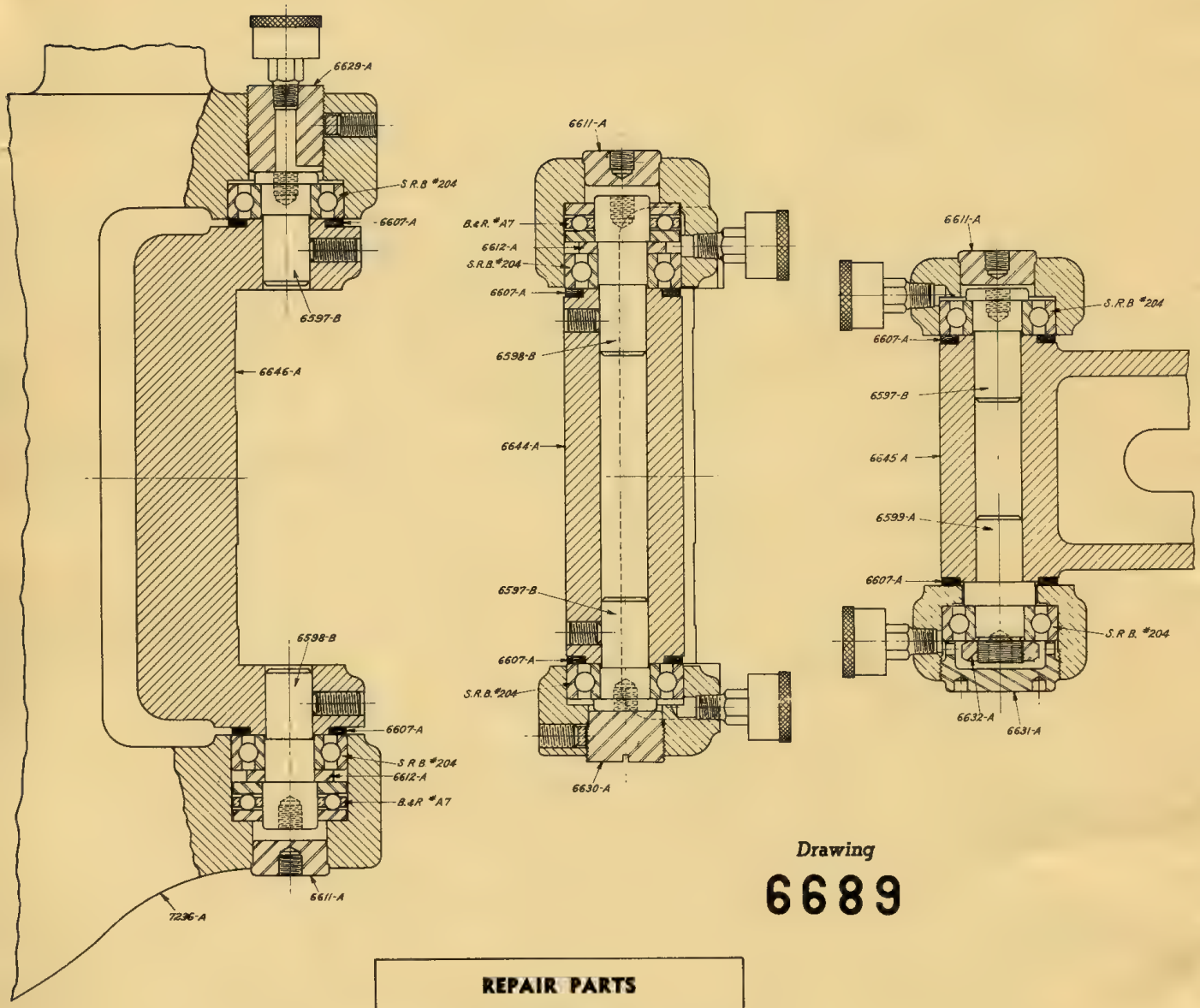
REPAIR PARTS

IMPORTANT

When ordering repairs parts, give serial number of machine found on pad at top of slider head.

3-S Machine (Continued)

PANTOGRAPH BEARING ASSEMBLY and PARTS DRAWING



Drawing

6689

REPAIR PARTS

IMPORTANT

When ordering repairs parts, give serial number of machine found on pad at top of slider head.

3-R, 1-H, 3-H, 3-K Machines
INSTALLATION, LUBRICATION and ADJUSTMENT

UNPACKING and ERECTING

Follow instructions as outlined on page 3.

LUBRICATION SCHEDULE

Read first Lubrication Instructions, page 4; then, using oils and greases recommended, proceed as follows:

Schedule for Model 1-H, see page 22.

Schedule for Models 3-K, 3-R, 3-H, see below.

ADJUSTMENT

For 3-H and 3-R models same as for 3-Z (or 3-X).

For 3-K model see page 10, and note instructions as for proper handling of removable spindle 698-1 on this model.

(For further information on the 3-K, refer to Form 2013.)

THE CUTTER HEAD LINKS

For Models 3-K and 1-H follow instructions as for 3-F and 3-U, page 7.

IMPORTANT 3-K INSTRUCTIONS

Before attempting to adjust or disassemble the ball bearing cutter head auxiliary support, as shown in drawing 7554-B in Booklet 1242, send to factory for complete assembly drawings of these parts and instructions. This entire assembly must be in perfect alignment to insure smooth and accurate operation, and it can easily be thrown out of adjustment or damaged by incorrect adjustment. For additional instructions on these machines consult the following specification booklets:

3-K.....see Booklet 1242

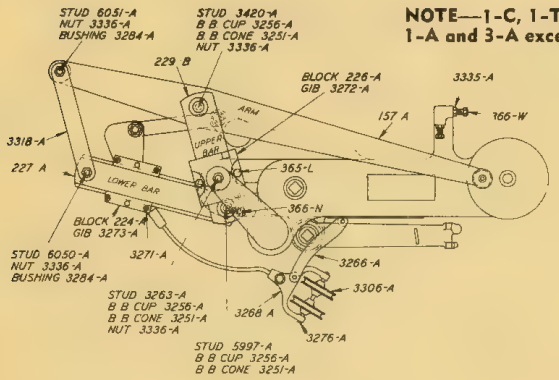
3-R.....see Booklet 1256

3-H.....see Booklet 1060

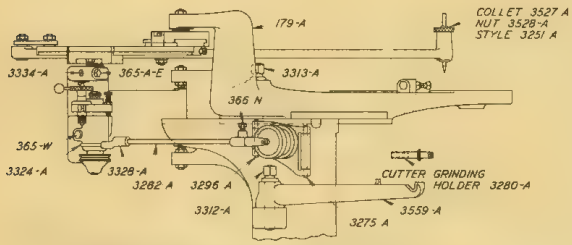
1-H.....see Booklet 1057

Accessories for use with these machines in Gorton Accessories Catalog. Copy for use with these machines in Gorton Master Copy-Type Catalog.

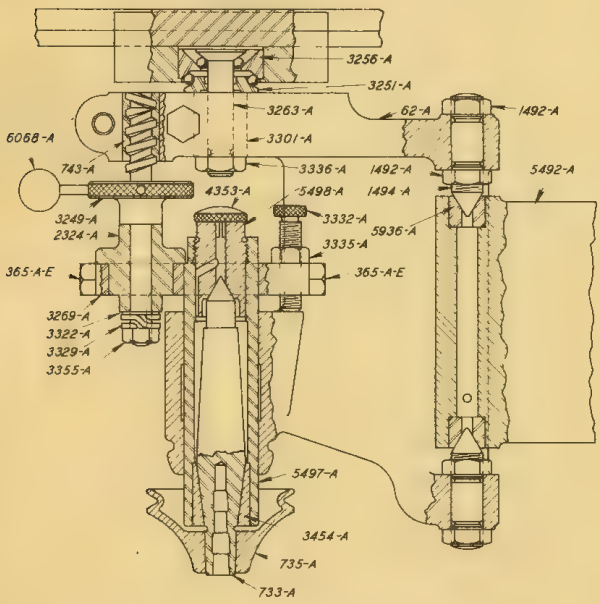
LUBRICATION and ADJUSTMENT—Identical for All Models on Pages 21, 22



NOTE—1-C, 1-T and 3-C, 3-T are identical with 1-A and 3-A except for Pantograph reductions.



PANTOGRAPH ASSEMBLY
No. 1-A ENGRAVING MACHINE. DRAWING 9340



CUTTER HEAD ASSEMBLY
No. 1-A ENGRAVING MACHINE. DRAWING 9339

LUBRICATION SCHEDULE

Read first, Lubrication Instructions, page 4 then, using oils and greases recommended, proceed as follows:

Oil twice a day

Cutter spindle, through oil holes in top; see drawing at left. Guide pulley bearings, see drawing. (For Models 3-A, C and T guide pulley oiling, refer to page 7. All other lubrication same as for Models 3-U (or 3-F) on page 7.

Once a week

All other oil holes and cups. (Remember to replace all oil hole plugs.) Run work table out to extreme positions and squirt a few drops of oil on table and saddle screws.

INTERMITTENT LUBRICATION
(Once a month or year)

Follow detailed instructions as given for Models 3-U (or 3-F) on page 7.

PANTOGRAPH

Pantograph requires care only in proper greasing as per lubrication schedule. If play develops in the link joints after several years' use, it can easily be adjusted by tightening nuts on Pantograph studs. Excessive tightening may cause the balls to cut into the cups, causing wear and inaccuracy. Tighten these very little. Before adjusting nut, loosen cap screw 365-A-E on cutter head, to allow Pantograph to align itself properly. Then remove Pantograph entirely and test the Pantograph block only, with cutter head swung out of the way, and test Pantograph bearings.

Finally tighten nut on these links, working arms to "feel" when play is removed so that links move firmly without binding.

GENERAL CARE

Machines should be thoroughly cleaned at least once a week and the scraped ways wiped clean and oiled.

Area Charts

Areas covered at one setting for all machines listed on these two pages show actual size in back of this book.

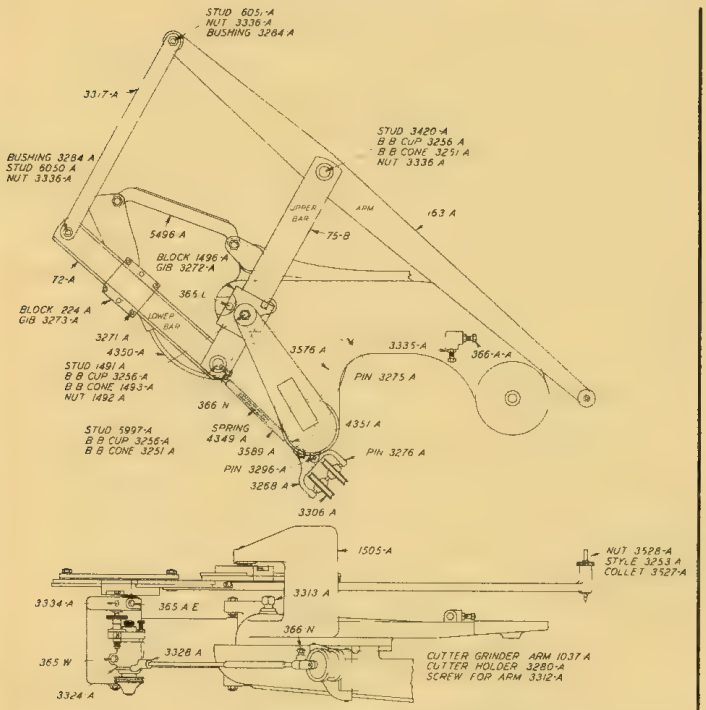
Accessories for use with these machines in GORTON Accessories Catalog. Copy for use with these machines in GORTON Master Copy-Type Catalog.

IMPORTANT—When Ordering LINK CENTERS, Please Specify Approximate Diameter.
—When Ordering REPAIR PARTS, Please Give Serial Number Located on Pad at Top of Slider Head.

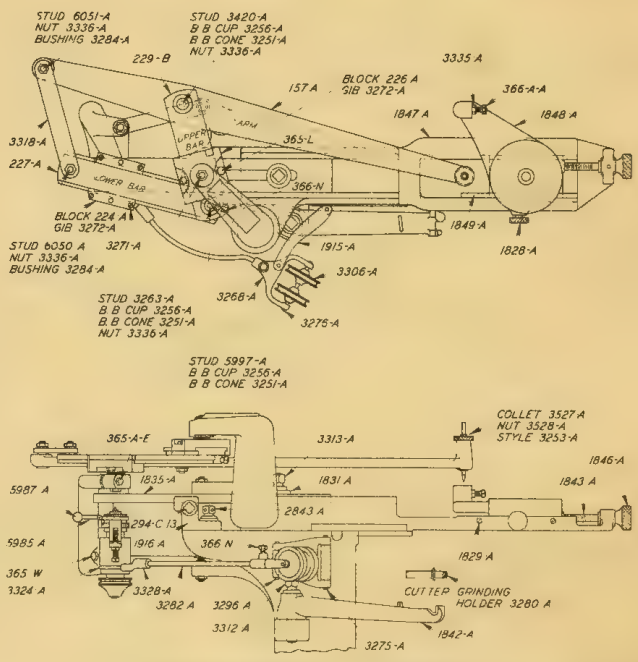
Models 1-D, 3-D, 1-G, 1-H, 1-J, 3-G, 3-J (All Now Obsolete)

REG U S PAT OFF TRADE MARK GORTON RACINE, WIS., U.S.A.

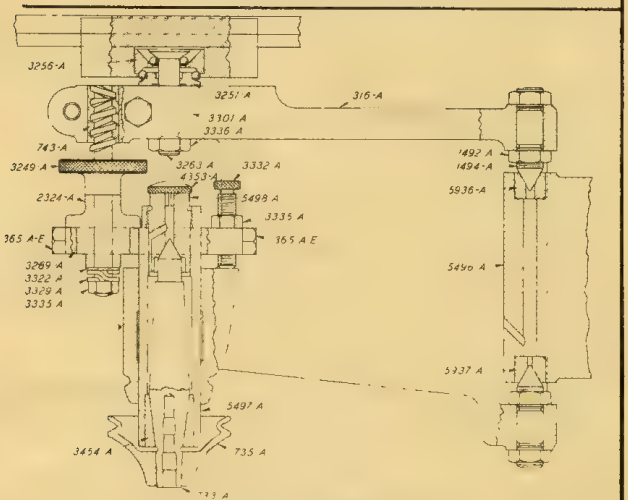
LUBRICATION and ADJUSTMENT — Same as on page 21



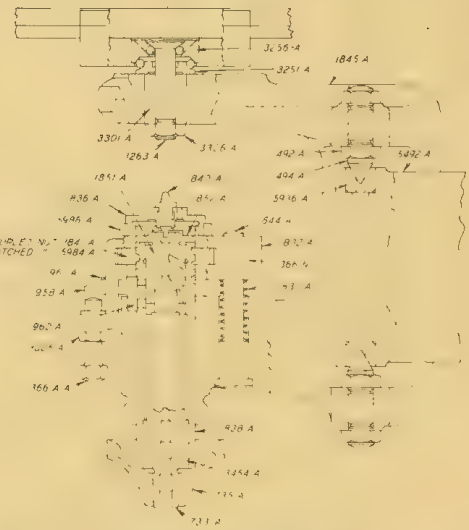
PANTOGRAPH ASSEMBLY
No. 1-D ENGRAVING MACHINE DRAWING 9383



PANTOGRAPH ASSEMBLY
No. 1-G & 1-H ENGRAVING MACHINE DRAWING 9338



CUTTER HEAD ASSEMBLY
No. 1-D ENGRAVING MACHINE DRAWING 9382



CUTTER HEAD ASSEMBLY
No. 1-G and 1-H ENGRAVING MACHINE DRAWING 9337

TO ADJUST CUTTER SPINDLE BEARINGS FOR 1-G, 1-H, 1-J, 3-G, 3-J

Remove cap on top of spindle sleeve, exposing end thrust. Loosen steel lock nut slightly, and using T shaped key, furnished with machine, adjust the bronze end thrust, which is threaded RH. Proper adjustment is obtained when, with driving belt removed, a very slight amount of shake is felt at pulley. When adjusted, tighten lock nut and replace cap. See drawing 9337, above.

IMPORTANT—When Ordering LINK CENTERS, Please Specify Approximate Diameter.
—When Ordering REPAIR PARTS, Please Give Serial Number Located on Pad at Top of Slider Head.

SETTING THE PANTOGRAPH, USE OF COPY, MASTERS AND TEMPLATES

1. Setting the Pantograph

The copy is laid out to keep within the range limits of the Pantograph. See the charts in the rear of this book. The setting of the Pantograph is then determined from the size of the work to be engraved.

2. Example: If length of copy is 10" and length of job desired is 2", divide the length of job into the length of copy: 2") 10" = 5. Therefore, set your Pantograph bars at reduction 5. If length of copy is 11" and length of job desired is 4", then the reduction is 4") 11.00" = 2.75. You will note that reduction 2.75 is *not* marked on Pantograph bars. To find it, look in rear of this book at correct Reduction Chart for your machine. If it is not found there, it can be obtained by using the reduction formula, also at back of book.

3. All settings are measured from the first reduction marked on machine. On some models this begins with 1 and 2, others 2, and others 3. (Note: on 3-U and 3-Z machines, measure upper bar from line marked 2, not 1.) For special reductions if accurate work is required, use hundredth inch scale and magnifying glass.

It is best, after a special reduction has been set, to check pantograph. First place a point in spindle, then raise table, until point clears by a fraction of an inch; next follow inside of copy holder with tracing style. If the point follows parallel to T-slots, the reduction is proper. If the point forms an arc or angle, the setting should be recalculated and reset. If point still runs off, it can be corrected by loosening either of the slider blocks and tapping, one way or the other, until path of point is parallel.

(For 1 to 1 reduction on 3-U, 3-F, 3-Z and 3-X machines, transfer style collet from end boss to second boss on tracer arm, set lower bar on graduation marked 1 and 2, and upper bar set on graduation 1.)

4. To set the Pantograph, proceed as outlined in paragraph 6, page 3. Never force the Pantograph bar blocks by striking with a hammer or any hard object. These blocks are tested before leaving the factory and, if at any time while setting the Pantograph, you find these blocks too tight, ascertain the cause. It may be that you have not loosened the nuts sufficiently, or they have become gummed with oil.

5. Use of Copy, Masters or Templates

The originals from which reproductions are made are known by various terms. "Copy" is the term most used. It applies specifically to the standard brass letters or type which are set up in the copy holder of the machine and which guide the Pantograph in reproducing. Shapes as distinguished from characters are also called masters, special copy, or templates.

6. Over 800 sizes and styles of special copy are listed in our Master Copy-Type Catalog. The examples shown on the cover of this Catalog will give a good idea of the variety of forms available for Pantograph work. In this Catalog the setting up and use of standard copy on the machines, the simplified ordering instructions, the suggestions for making up copy in special shapes, etc., will be found helpful.

7. The numerous illustrations of actual work, produced with various kinds of copy, in our Pantograph and Duplicator Bulletins will also be helpful in considering copy.

8. As a rule, copy is not strictly self-spacing, therefore the spaces between the characters should be adjusted by inserting suitable blank spacers which are furnished, when necessary, with each set of copy. Each line when set in the copy-type holder should be held tightly between the clamps furnished, as shown in Fig. 3, page 24.

9. After setting up the copy-type in the holder, and before engraving, be sure that the holder is firmly against the stop screws "N" or "T" (page 3) in copy holder base. It is then square with table. Do not disturb these stops. They are properly adjusted when machines leave factory, and any change will throw copy holder out of square with table. T-slots in the machine table are also parallel with front edge of table. This is also true of T-slots or dovetail grooves in copy holders. This makes it easy to set up work and copy in accurate parallel relation to each other.

10. When several lines of reversed type are set up in a copy holder, an easy way to check for spelling and position of characters is by making a rubbing with a sheet of tissue, then look on reverse side and read.

COPY HOLDERS . . . USE OF TRACING STYLES

Figs. 1 and 2 replaced by Fig. 3.

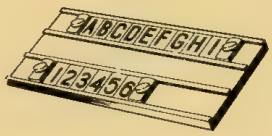


Fig. 3—Copy-Type Set up in Copy-Type Holder

COPY HOLDERS

Copy is held on the machine by means of the copy holders provided for that purpose. A number of different styles and sizes are provided. These are illustrated in the Gorton Accessories Catalog. Where special copy is used exclusively, we recommend holder 8-2, or for very large copy plates, holder 36-1. Gorton standard brass copy characters have beveled edges fitting the beveled groove holders. All these holders are interchangeable, can quickly be removed from the machine whenever the work requires different sizes of copy, etc.

USE OF TRACING STYLES — KINDS

Three different kinds of tracing styles are used with Gorton Standard Pantograph machines. For all cutting of sunk letters and designs from 90 degree V-Groove copy, as shown in our Master Copy-Type Catalog, style No. 3253-A (in our Accessories Catalog) is used. For cutting sunk letters and designs from square bottom groove copy, also for relief (raised) letters and designs from relief copy, the 25-1 or 795-1 tracing style sets are used. See our Accessories Catalog.

For 3-B and 3-L 3-dimensional machines, round nose tracing styles are used a great deal. Such tracing style sets are illustrated in our Accessories Catalog.

CARE AND USE OF STYLE 3253-A (Figure 4 at right)

This style should be kept ground to a cone of 90 degrees included angle in a Gorton cutter grinder by means of the 2/10" dia. collets which can be supplied for this purpose. See our Accessories Catalog. If the grinder is not of the collet type, use the small V block attachment furnished, and the small collar which slips on style. All sunk V-Groove copy is made to 90 degree angle and if the style is not accurately ground to this angle and kept sharp, the copy-type will soon be damaged so as to cause imperfect lettering.

Keep copy-type grooves clean by rubbing out several times a day with slightly greasy rag. This takes but a few seconds and style moves over the copy with much less effort. The style, when placed in the lines of the copy, should be clamped in its collet on the long arm of the Pantograph in such a way that no excessive straining of the Pantograph joints is caused. The slight springing when the style is moved from one letter to another will do no harm.

CARE AND USE OF STYLES 795-1, 25-1 (Figure 5 below)

These are for engraving raised letters and designs, or sunk lettering in which the thickness of line is not uniform, as it is with plain block letters. Where the reduction ratio is large, the styles and rollers 25-1 are used. Where it is small, and for final finishing, the styles without rollers (795-1) are used.

If the cutter is in the exact ratio of reduction to the styles to which the Pantograph is set, the forms engraved will be accurately proportioned to the forms of the copy. The exact size may be conveniently calculated in decimals of an inch by reducing the diameter marked on the roller in the ratio of reduction to which the Pantograph is set. Thus, if the Pantograph be set to reduce to one-tenth the size of copy, a cutter .06" diameter must be used with the .6" roller. It is generally desirable to use the largest roller with a proportionately large cutter to do the rough work of outlining and removing the bulk of the stock, and to use the smaller rollers, or styles alone, with corresponding cutters, only when necessary to reach into fine spaces or corners of the work.

CARE AND USE OF ROUND NOSE TRACING STYLES (Figure 6)

The same general rules apply as above, except that for accurate work the round nose of the style must be ground to exact radius, as well as the style diameter. The same instructions apply as for grinding round nose cutters, page 36.

Fig. 4 Using Sunk V-Groove Copy on Machine

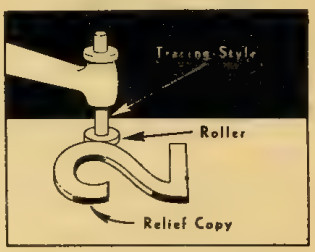


Fig. 5 Using Relief (Raised) Copy on Machine

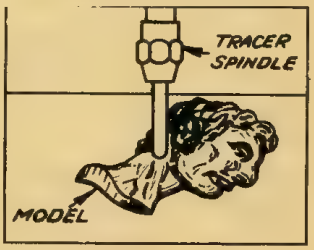


Fig. 6 Using Model on 3-Dimensional Machine

MAKING SPECIAL COPY or MASTERS for FLAT or 2-DIMENSIONAL WORK

BRISTOL BOARD

When sunk, V-Groove characters or designs are to be cut in fairly soft materials as wood, Bakelite, fibre and sometimes brass, the design may be drawn on or transferred to a piece of Bristol board. Then, using a small knife or tool with a beveled edge ground to 90 degrees included angle, and having a slightly dulled point, run over the drawn lines. Press fairly hard so as to get a line 1/64" to 1/32" deep. Now smooth over this line with a hard lead pencil having a point approximately 90 degrees also. This smooths out the roughness. Then give the whole a coat of shellac for added stiffness. Bristol board copy should always be made up 3 to 10 times larger than the work, and never used to produce very accurate work.

TRANSPARENT CELLULOID

Transparent celluloid, preferably about 1/16", can be conveniently used as master copy for cutting in harder materials than given above under Bristol board, and is satisfactory for light cutting in steel. It is largely used for jewelry dies and other dies and molds where the entire design is cut sunk in the die or mold. The transparency of this material permits laying the drawing under the celluloid and cutting in the lines as described above, using a hollow ground 45 degree angle hand graver. It is not necessary to go over the lines with pencil or to shellac as it is with Bristol board. An oily rag rubbed over the celluloid copy will cause the tracing style to follow the grooves more freely.

LINOLEUM

Linoleum such as artists use making block prints, about ⅛" thick, is also suitable for light cutting in steel and for the same character of work as the celluloid. We find that for linoleum it is best to cut in the designs, using a round nose tool instead of an angular one. The tracing style of machine is then rounded to conform and polished for greater smoothness. A little oil rubbed on the copy helps the tracer to slide smoothly.

BRASS

All Gorton standard copy is made of brass. It is the material most generally used where a permanent copy is desired and where it is necessary to do heavy cutting. Get Engraver's brass such as listed in the Gorton Master Copy-Type Catalog. Ordinary brass is hard to work, and raises a burr when cut. Since brass is so much harder than any of the foregoing materials, it is not practical to work it with a hand tool and it will be found necessary to rout in the designs on a vertical miller, or by using the Pantograph machine spindle locked in the routing position. Swing the radii required for characters and designs with a circular table or by means of the graduated circle copy illustrated in our Master Copy-Type Catalog. This latter device will be found very convenient even where a circular table is already at hand.

DOW METAL

This is obtained in sheet, rods, etc., from Dow Chemical Co., Midland, Michigan. This is lighter than aluminum and freer cutting than either aluminum or brass. It is very useful for masters requiring deep cutting with small delicate cutters.

ZINC

Zincs made by a photo-engraver, direct from a drawing, are often used for reproducing raised patterns of intricate design in steel dies. This process eliminates practically all hand work in producing the master, frequently saving much time. A drawing of the design, exact size of master desired or enlarged, is given to the photo-engraver and he reproduces it to the desired size in the zinc. Special instructions should be given to etch the plates deeper than standard for ordinary printing practice 1/32" deep if possible. Before using the zinc on the Pantograph machine, trim up all the lines to eliminate any ragged edges, and leave a square bottom to the etching.

HARD CHROME—Plated Brass Type

Hard chrome plated copy-type, both standard and special, can now be furnished. This is less expensive than steel copy-type and stands up well under hard usage.

STEEL

For production work where copy will be traced thousands of times and subjected to continual hard use, steel copy, hardened, is often used. This is particularly true where heavy cutting will be done, such as the profiling illustrated in Gorton Pantograph Engraving Machine Bulletin.

SPECIAL COPY

We specialize in the making of special masters for those companies not having facilities or time to make their own.

Making Models for 3-Dimensional Work

METAL MODELS

For reproduction of extremely delicate detail such as might be required in a model for the floral design on a silver spoon die, or a die simulating feathers on an eagle's head involving hundreds of minute lines and reliefs, it is almost impossible to reproduce from anything except hard metal. Softer materials will chip or scratch, and if this happens when the die is almost finished, it is very often spoiled. There are several methods for making metal models.

MAKING MODELS for 3-DIMENSIONAL WORK

(CONTINUED)

METAL MODELS FROM WAX OR CLAY

Sculptor's models of wax or clay can be used as originals for the making of working models to use on the Pantograph machine by pouring a stone mold around them as outlined under "Stone Composition Models." From this stone mold a hard alloy brass casting can be poured. Ordinary brass castings are too soft, but properly alloyed the material can be made extremely hard, so as to withstand pressure of the smallest tracing point without denting or breaking off. Such hard alloy brass models are generally preferred for such delicate designs as are mentioned in the first paragraph.

METAL MODELS BY THE ENLARGING PROCESS

A new photographic process is now being used for making enlarged models. This method is being used successfully in many types of work.

CAST IRON AND BRONZE MODELS

These materials make good models, the cast iron being practically as good as a steel original, for all but the smallest raised designs, on which it is more apt to crumble.

METAL COATING OF MODELS

Several spray gun processes are now used for spray coating with almost any metal desired. One of these methods, known as Metallizing, is available from the Metallizing Company of America, with branches throughout the country. By this process a hard metal coating may be sprayed over a soft base, as steel over brass, lead bronze or zinc, etc. We do not recommend the process for coating stone or wood models as the thin metal coating (four to ten thousandths as desired) does not form a perfect bond and tends to loosen and crack under continued pressure of the tracer. See also at right, "Material for proof castings and impressions."

BAKELITE AND OTHER PLASTICS MODELS

These materials make very good models, and can be easily worked by hand or with a milling cutter. Other materials than Bakelite which we recommend are: Catalin, made by the American Catalin Corporation, 1 Park Ave., New York City, or Marblette made by the Marblette Corporation, 37-21 Thirtieth St., Long Island City, N. Y. Any of these materials can be obtained in blocks, sheets, and rods. They can be sawed, drilled, planed, carved and polished.

HARD WOOD MODELS

Hard wood can be used but we recommend the plastic materials as being harder and less likely to be dented by the tracing style. The size and shape of smallest tracing style will largely determine the hardness required in the model. Where hard wood is used, seasoned close grained stock should be selected, and cutting or carving should be done on the end grain if possible.

STONE COMPOSITION MODELS

For comparatively simple shapes, having smooth, flowing lines without sharp corners or projections which might chip off, stone models are very practical and the least expensive of all to make. They consist of a powder and liquid which is mixed together and poured into a mold or around the original to be reproduced. The materials recommended, when fully set, in 12 to 30 hours have a tensile strength upwards of 1,000 lbs. per sq. inch with a smooth, hard surface. They do not expand, warp or crack and hold accurately to size and detail. These materials can be turned, planed, drilled, filed or finished and when fully set resemble marble in hardness. The makers issue complete instructions for use. We recommend the following: Titanite made by The S. Obermayer Co., 2563 W. 18th St., Chicago, Ill., with branches in Cincinnati and Pittsburgh. In using these materials it is advisable to sprinkle model with powdered graphite.

In reproducing from stone composition models, the ground tooth burrs shown in our Accessories Catalog will be found very useful — on account of the many flutes continuously in contact with the work, chatter and possibility of chipping the model is greatly reduced. These burrs will also produce an extremely smooth finish.

MATERIALS FOR PROOF CASTINGS AND IMPRESSIONS BISMUTH ALLOYS

The Cerro de Pasco Copper Corporation, 44 Wall St., New York City, make a Bismuth Alloy known as Cerrobase, which melts at 255 degrees F. and has a zero shrinkage. This is suitable for making proof castings of dies and molds. It can also be used for models, but is rather soft and easily dented with a sharp tracing style. It is quite strong, however, and forms a good base for a hard spray gun coating or electro-plate coat of hard chromium. With this treatment it makes an excellent model.

PUTTY

Another very satisfactory and inexpensive material which we use altogether for taking impressions of dies and molds is our Gorton Impression Putty, put up in ¼ lb. pieces. This can be driven into the mold and pulled out, retaining its shape better than ordinary plastilene or modelling clay commonly used. The material is listed in Accessories Catalog. In using, we place it on the end of a hard wood block or dowel if for a small die, driving it in by striking the wood block with a hammer. To remove from die, pull away the wood block, and if care is used the putty will come with the block.

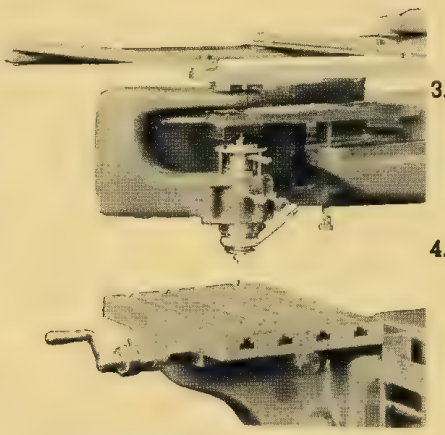
SCOTCH TAPE

Double faced Scotch Tape is now being used extensively for use in making special masters and for holding down small work which cannot be held conveniently in clamps, vises or other work holding fixtures. To use, place tape on brass sheet, making sure tape is smooth, and press on, then place copy type or work on top of tape. Pressing down with arbor press will make copy type or work hold securely enough for any ordinary work.

USE OF FORMING GUIDE

For curved work on all 2-dimensional type Gorton Pantograph machines a hardened steel forming guide is necessary in addition to the flat copy or master template. Illustrations of the forming guide in use are shown on these pages and in the Gorton Pantograph Engraving Machine Bulletin. Various types of forming guides are illustrated here.

The forming guide should be the exact opposite of the work and preferably made of tool steel hardened. For instance, if the work is convex, the forming guide should be concave. Before using, its contour should be matched precisely with the part to be engraved. This is done through the use of lamp black, mechanic's blue, etc.



Forming Guide Shown in Circle

The making of forming guides can be avoided, in many cases, through the use of adjustable forming guides, described in our Pantograph Bulletin. These save the expense of making hardened guides from solid steel blocks.

Forming guides may be made by turning on a lathe, shaping on a shaper, milled with a formed cutter or by hand with a file or hand grinder.

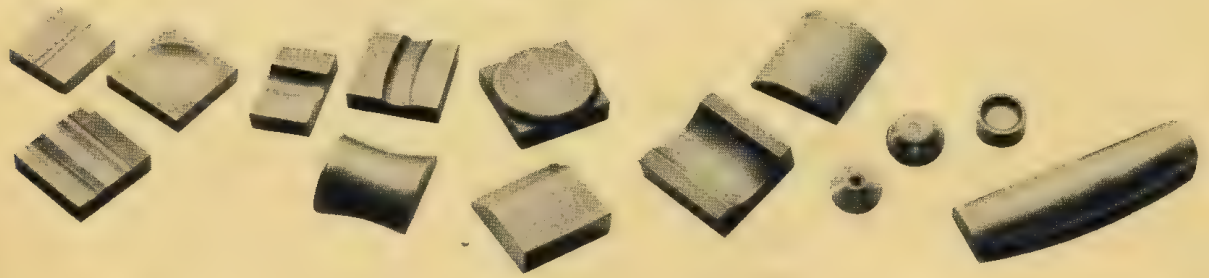
The forming guide is secured to the forming bar by means of four small screws in position shown in photographs.

Assuming that the work is secured to the work table and copy on copy holder the general procedure is as follows: (A detailed account of one particular setup is described later).

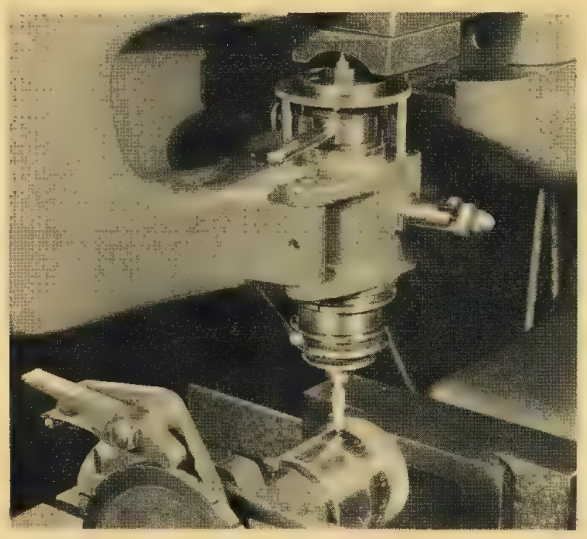
1. Check to see that cutter point and former point are approximately the same size, especially on a small radius.
2. Lock spindle floating movement and locate work in relation to copy.
3. Release spindle floating movement and allow former point to come in contact with guide, which should be directly above work.
4. Extreme care should be observed in locating forming guide in relation to work. Place a cutter blank, having a conical point, in the cutter spindle and raise work close to cutter. Now move the cutter point over surface of work by moving tracing style. If the point does not follow the curved surface of the work, move work table in the necessary direction.
5. When the work is in direct relation with the forming guide, the copy will probably be found out of alignment with work, due to moving the table.
6. Copy should now be located by shifting it back and forth and placing tracing style at extreme points, noting when cutter point locates laterally with work. After lining up, lock the table and do not move again.
7. Cover forming guide with grease so former point will slide without friction.

When this has been done, the engraving can proceed without further thought to the forming guide. The spring in the spindle will always keep the former point secure against the guide, thus causing the cutter to follow the same course as the forming guide surface.

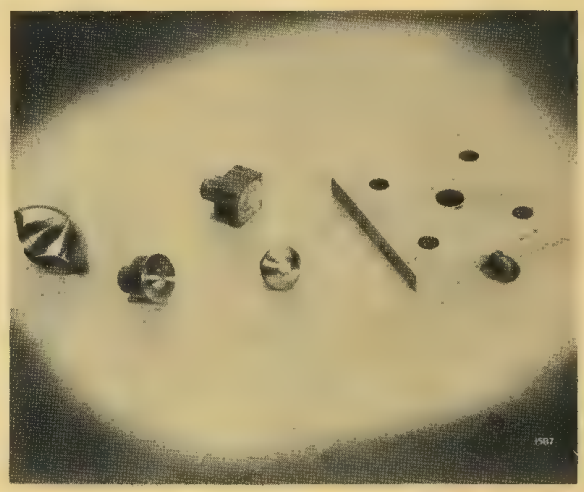
TYPICAL FORMING GUIDES



SETUP TO ENGRAVE STRAIGHT DIAL



Showing Relation of Forming Guide to Work



Other Forming Guides and Holder

Place dial on work holder 53-1 or 256-1 and make sure dial is running true by indicating within .002". Square work holder with table T-slots and clamp tight. Fasten forming guide, exactly the opposite shape of the dial, to former bar — square with the bar.

For this work, we should use circular copy holder 33-1 in which copy cannot be shifted sideways, making it necessary to shift work instead, when lining up.

Turn copy dial to centerline of zero, which should have a center line. Place tracing style in center line and place a point in spindle. Then line point with approximate center of dial. Loosen former lock pin in front of spindle and make sure spindle works free and that the former point follows guide perfectly.

If spindle does not "float" freely, it may be due to belt tension being too great. If spindle sticks after adjusting belt, remove spindle, clean and coat with light oil.

Bring point to about 1/16" from work, then move tracer to see if point follows job surface for about ¾" each side of center line. If it appears to follow closely, move the work closer to point and continue to move style back and forth. As the point gets closer to the work check to see if the point comes closer to one side than the other of the dial. Compensate by moving table until the point follows surface perfectly.

Next loosen nut holding dial in place and turn dial until the index line, which is to match the zero, lines up with point when style is in the center line on master.

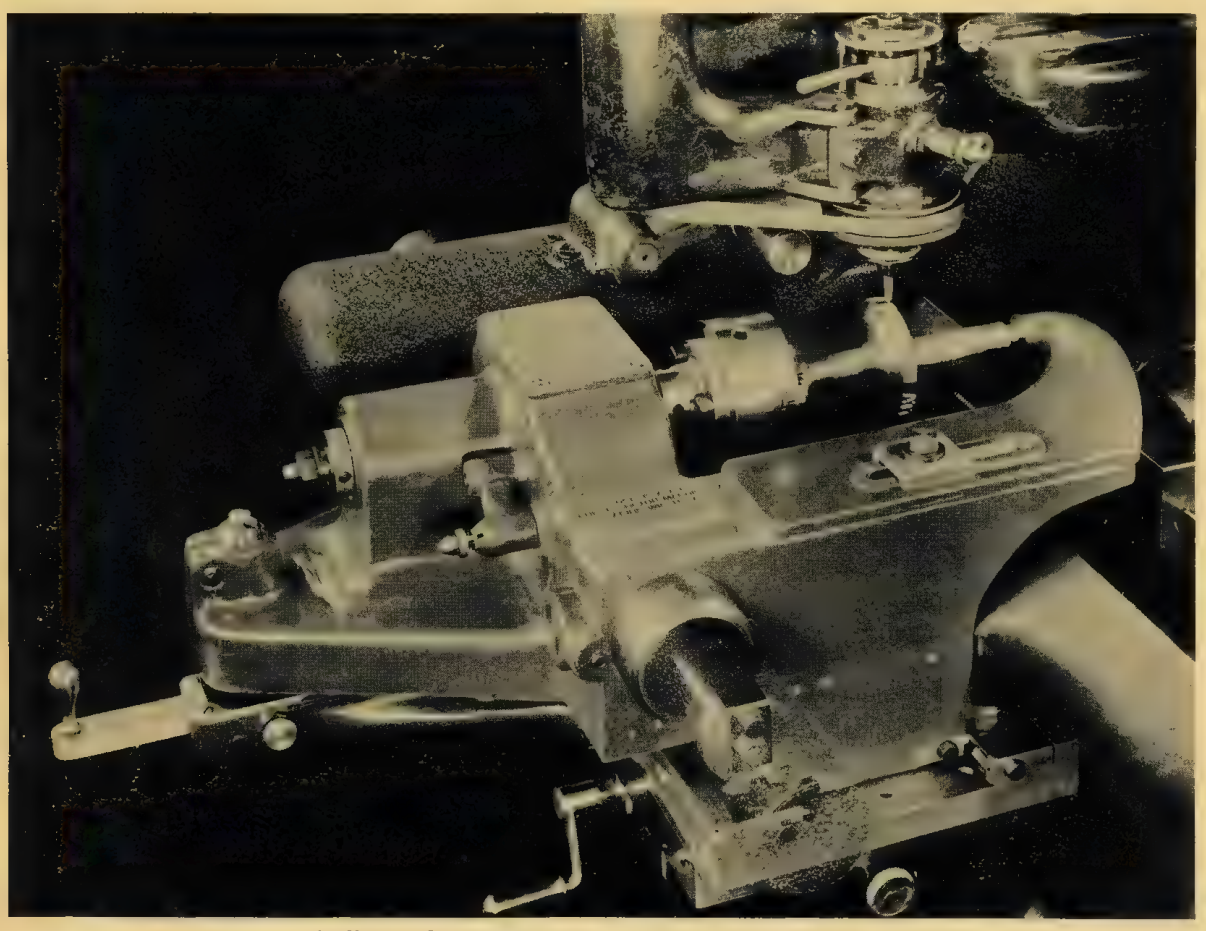
The job is now ready to be engraved. Remove point and place cutter in spindle. Cutters ground 60 degrees included angle degrees are recommended for most work of this kind. Use cutters suited to job if it runs eccentric or a steeper angle is preferred.

Cut about .007" deep for numbers. If job runs eccentric, or a steeper angle is required, cutters ground to suit the particular job.

GENERAL FORMING GUIDE SETUPS

1. Concave surfaces are primarily the same as described for straight dial work.
2. Jobs where whole copy plates are used are treated practically the same as the above, with the exception of truing the job up with the former, then placing point in center of job and moving copy plate until style point falls in center hole of copy.
3. Jewelers find that for intricate work a special Matrix Feed Works No. 205-2 (shown in Pantograph catalog) proves quite useful. This device gives the operator more feel and control of the cutter, resulting in greatly increased accuracy of work.
4. In jewelry die work, operators find it works well to use drill rod blanks turned to the proper form and hardened. These blanks are turned to a 5/16" shank. These formers fit a special holder which fastens onto the former bar the same as a solid forming guide. Formers may be changed in this holder in a few seconds. (Holder and a few guides are shown in photo at top right, above.)

ROLL ATTACHMENTS



Roll Attachment 727-1 on 3-U Pantograph Machine

727-1 ROLL ATTACHMENT

*MOUNTING

On 3-L 3-dimensional machines, place graduated scale of roll attachment toward operator's position. On other late model Pantograph machines the scale should point towards front of machine.

Lower machine table and wipe clean. Match bolt holes in attachment with T-slots and tighten bolts in place, making sure the attachment is square with front of table. Free lock on top slide and lower base to permit attachment to move freely.

On 3-L and 3-U machines shipped since June, 1939, cutter heads have been prepared for use with the roll attachment. Older machines of these models and all 3-Z and 3-B machines must have cutter heads prepared for mounting the attachment. This may be done by the user, or the cutter heads may be shipped to the factory to be fitted free of charge.

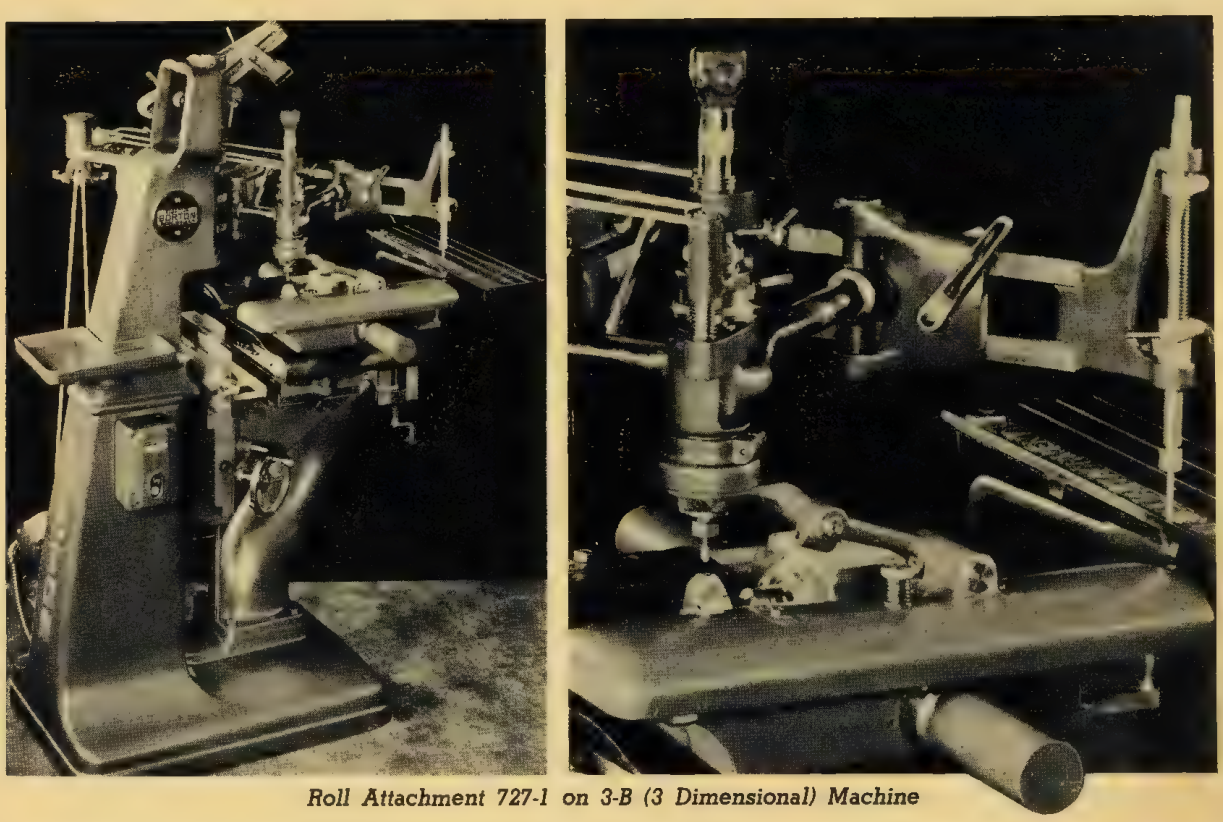
ON 2-DIMENSIONAL MACHINES: Belt must be removed and belt tension rod and brass fork that fits against spindle removed by loosening slip nut. Then lock spindle in lowest position. Next insert dowel pins of attachment connecting bracket to cutterhead with set screws. Then replace belt tension rod and put belt over proper pulley and tighten.

ON 3-DIMENSIONAL MACHINES: Fasten bracket connecting with upper slide of attachment over machine spindle, when spindle is locked in lowest position. It is not necessary to remove belts or tension rods on these machines.

Rotation of attachment spindle is accomplished by a steel band, running over rollers, under sufficient tension to prevent slippage of the spindle. The band is adjusted before leaving the factory, and should not require any attention for a long time. If this band should require tightening, remove the tubular shields by loosening the small set screws. The tension adjusting screws can then be adjusted to exert more tension on the band. Excessive tension should not be applied, only enough to prevent the spindle from slipping. If the band is too tight it will cause the mechanism to drag, and not operate as sensitively as it should. Band should be left slack when attachment is not in use.

For mounting work on the attachment spindle, the tension on the band should be released by means of the small lever with plunger locking pin, bringing

**Send to factory for print showing mountings for various models.*



Roll Attachment 727-1 on 3-B (3 Dimensional) Machine

it to an up-position. The spindle and work can then be rotated freely without any movement of the carriage slide and the work can then be properly lined up and the lever returned to its locked position, which will automatically tighten the band to its original tension. As the lever is moved to its locked position, the work may rotate slightly and if it is necessary to line the job up accurately with the cutter, it is only necessary to move the table slightly with the table screw. Work placed on the machine may be held with a chuck, arbor or special fixture, and should be accurate to .001". Check attachment to see that it runs true with the copy holder, by placing a point in the spindle, and moving tracing style along edge of copy holder to see if the point follows edge of roll to be engraved. If the point does not follow properly, loosen fastening bolts and adjust attachment on table until roll is parallel with spindle movement.

Measure diameter of roll to be engraved, loosen brass thumb screws holding engraved scale and set scale for proper diameter. Each graduation on scale is for 1/16" of diameter. Then center work with master. Replace point in machine spindle with cutter and proceed with engraving the same as on flat work, with the exception of taking lighter cuts. Cutter must be kept sharp, even more so than for highly accurate flat engraving, to insure a clean, even cut.

It is important that the ball bearing slides be kept clean and free from chips. While the slides are protected by shields and leather chip aprons, the use of an air blast in cleaning the machine may force some chips into the ball bearings, causing the slides to stick and possibly damage them. For this reason it is advisable to use a brush for removing chips.

750-1 ROLL ATTACHMENT

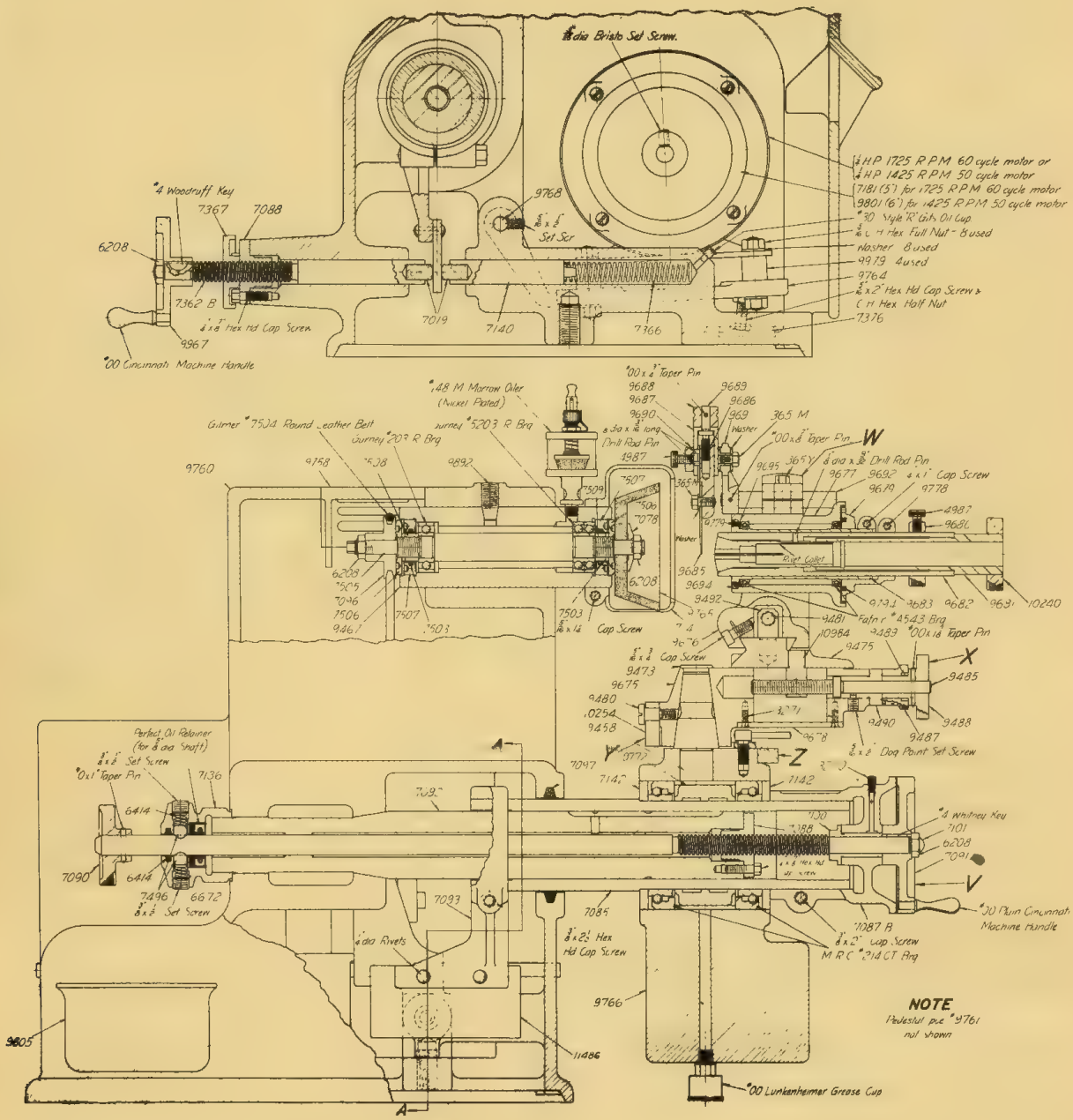
Roll Attachment 750-1 can be used only with 3-L and 3-Z machines. On these machines the mounting and operation is exactly the same as with the 727-1 Roll Attachment, the operation of which is described above, except that only one-half the roll, regardless of diameter, can be engraved at one setting.

The graduated scale is set for the exact diameter of the roll to be engraved (each graduation represents ⅛" of diameter) and engraving started, first making sure the engraving to be done will exactly surround the roll or portion of roll to be covered.

When half the roll has been engraved, release drive band tension by means of the small lever with locking pin bringing it to an up-position. Then revolve roll until work corresponds with copy with first character of copy remaining to be engraved following last character engraved. It will be necessary to reset copy in most cases, moving unfinished portion to opposite end of copy holder. (An aid in resetting work is the carrying over of the last character engraved so that copy and work can be lined up accurately.)

Otherwise, proceed exactly as with the 727-1 Roll Attachment.

375-2 Cutter Grinder with 717-1 Universal Head—

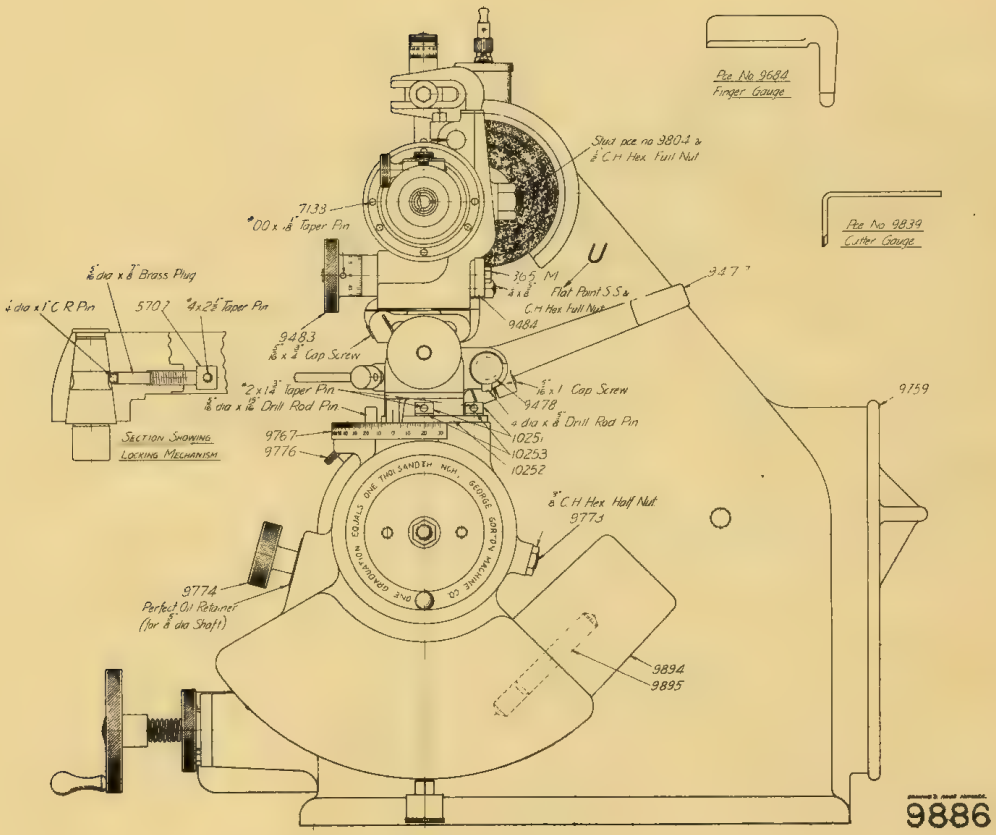


LUBRICATION: For spindle keep oiler filled with Gargoyle Spindle Oil Velocite Oil "S" or equivalent. Turn down grease cup once a week and refill with Gargoyle BRB No. 2 or equivalent. Use light or medium machine oil at all other oiling points — once a week.

SPINDLE: Is non-adjustable type. Return to factory for adjustment or repair which should only be required after years of service.

ADDITIONAL HEADS FOR USE WITH 375-2 GRINDER
(Not Shown on Drawing)

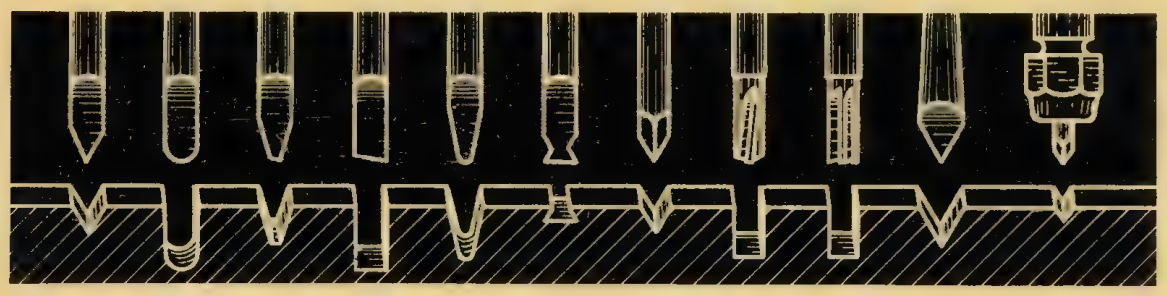
716-1 Plain Head.
737-1 "V" Block Head for 1-G, 3-G, 3-F and 3-U Removable Spindles.
738-1 "V" Block Head for 3-K, 3-L, 3-X and 3-Z Removable Spindles.



For CUTTER GRINDING INSTRUCTIONS and OPERATING SUGGESTIONS, see pages that follow.

For Mechanical Specifications and complete description of this and other Gorton Cutter Grinders and Accessories, see Gorton Accessories Catalog.

GRINDING — CUTTER SHAPES — WHEELS



Typical Cutter Points and Cuts

GENERAL

The importance of correct grinding of the cutters used on Gorton Pantograph machines cannot be stressed too strongly. Satisfactory work cannot be produced if the cutters have been incorrectly ground. The following instructions on cutter grinding should be read and carefull followed. It is *absolutely essential* that suitable equipment be available for grinding the small cutters used with Gorton machines. If you do not have such equipment, we would suggest the purchase of a Gorton 375-2 or 265-6 grinder, as shown in Gorton Accessories Catalog. Both these machines operate in the same manner. The 375-2 has many features not incorporated in the 265-6.

If no cutter grinding equipment is available, Gorton taper shank cutters can be ground on the Pantograph machine by using the mounted wheels described in our Accessories Catalog. Use maximum speed of 8,000 R.P.M. (The attachment will not handle straight shank cutters.) These have a taper shank and fit in the cutter spindle. The cutter is held by Attachment 288-1 illustrated on page 37. We do not recommend this method unless it is impossible to purchase a cutter grinder, as it throws grinding dust over the machine which works into the slides and bearings.

SHAPE OF CUTTER POINTS

Practically all of the cutters used in Gorton Pantograph machines are of the single lip type. A typical assortment is illustrated above. Occasionally for special work, 3, 4 or 6 sided cutters like cut above, are used. Standard spiral flute end mills are also used for side milling, as in profiling, and for some types of die-cutting. Reference to Accessories catalog will show suitable cutters, with collet, etc., for holding. In general, the single lip straight shank cutters are used for heavier work and the Gorton taper shank type for the lighter engraving of small characters and designs.

Single lip cutters are usually ground with a conical point, the angle depending on depth and width of face required. Tables of suggested angles and clearances are given on pages 34, 35, 36, 37.

GRINDING WHEELS

Use the correct grade of abrasive wheel as recommended in the Gorton Accessories Catalog. The wrong grade of wheel will easily draw the temper of small cutters and make them soft. Dress wheels frequently with the diamond dresser provided, and also listed in Accessories Catalog. This is very inexpensive and will repay its small purchase price many times over. (One is furnished with each Gorton grinder.) Occasionally go over wheels after diamond dressing with a star wheel dresser. Keep wheel free of grease and avoid touching with greasy fingers. Never grind continuously in one spot; keep tool moving. Keep wheel spindle snug and free from vibration.

Special wheels for grinding and lapping the new hard alloys are listed in the Gorton Accessories Catalog. These permit much faster grinding and lapping of these materials than heretofore possible. When grinding tungsten carbide tools dry, never dip in a coolant — it may cause checking. Do not force the tool against the wheel — use light pressures only.

GRINDING SINGLE FLUTE GORTON CUTTERS

Trueing Grinding Wheel — Fig. 1

Before grinding cutters, true up the grinding wheel using diamond tool 7566-A (Accessories Catalog) which is furnished with grinder. This tool has a taper shank and can be inserted in grinders having tool heads fitting Gorton taper shank tools only, or it can be held on its diameter in a ⅜" collet in any of the collet type tool heads. After inserting the diamond, set tool head at approximately the same relation to wheel as shown in Fig. 1. Then swing across face of wheel by rocking the tool head in much the same manner as for grinding the cutter. Avoid taking too heavy a cut from the wheel with the diamond. One to two thousandths of an inch should be the very maximum. If the diamond fails to cut freely, loosen it, and turn slightly in the tool head, so as to present a new and unused portion of the diamond to the wheel.

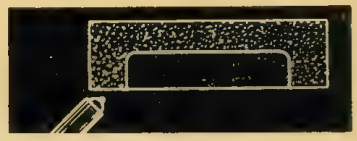


Fig. 1—Trueing Wheel

Rough and Finish Grinding Conical Point — Figs. 2 and 3

Set tool head of grinder to angle desired on cutting edge (see Fig. 2). This usually varies from 30 to 45 degrees, depending on the work desired. Recommended angles for relief characters on steel stamps for various work are given on page 41. For most sunk letter or design engraving on Bakelite panels, brass and metal plates, etc., a 30 degree angle is used (60 degrees included). Now place cutter in tool head and rough grind to approximate size by swinging across face of wheel as with the diamond dresser above. Do not rotate the cutter while in contact with face of wheel but swing straight across, turning cutter slightly *after* or *before* contact with wheel. This will produce a series of flats like Fig. 3, left. Now, grind off the flats and produce a smooth cone by feeding cutter into wheel and rotating at the same time. The finished cone should appear like Fig. 3, right. It should be very smooth and entirely free from wheel marks.

Fig. 2—Set Tool Head to Desired Cutter Angle

Fig. 3—Rough and Finished Conical Shape

Grinding Flat to Center — Figs. 4 and 5

Next operation is grinding the flat exactly to center. For average work this flat may be left a trifle full or oversize, up to half a thousandth. For very small delicate work however, it is absolutely essential to grind this flat *exactly* to center. If the flat is oversize it will be readily apparent after grinding the cone, and the point will appear as in Fig. 4. To correct this, grind the flat to center as in Fig. 5. For cutters used on very small accurate work, examine this point with a magnifying glass to see that flat and cone point coincide *exactly*. Be very careful *not* to grind the flat down *too far*. It is much better to leave it a trifle full.

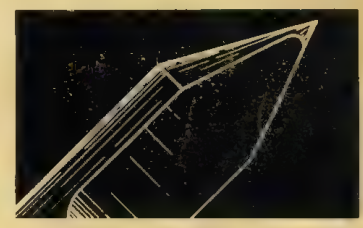


Fig. 4—Flat not Ground to Center

Grinding Chip Clearance

The cutter is now the correct angle, with a cutting edge, but it has no chip clearance. This must be provided to keep the back side of cutter from rubbing against the work and heating excessively, and to allow the hot chips to fly off readily. The amount of clearance varies with angle of cutter used. The following table will be found a very good guide in establishing sufficient clearance.

Conical Point Cutter Angles for Clearance

Angle at Cutting Edge	*Clearance Angle*	*Angle at Cutting Edge*	*Clearance Angle*
45	40	25	21
40	35	20	17
35	30	15	13
30	25	10	8
		5	4

Angles in table are for one side of cutter. For instance a cutter having 45 degree angle will have a 90 degree included angle. Now set the tool head for clearance angle desired. If the conical point was ground as described above, to 45 degrees, then a 40 degree clearance angle will be used. Set the tool head back to 40 degrees.

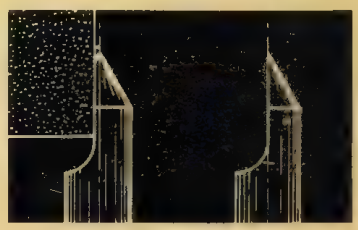


Fig. 5—Grinding Flat to Center

GRINDING SINGLE FLUTE GORTON CUTTERS

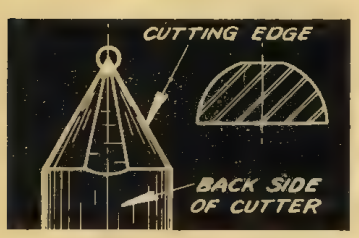


Fig. 6—First Operation in Grinding Clearance

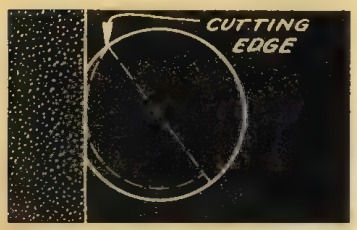


Fig. 7—Second Operation in Grinding Clearance

Fig. 8—Section through Cutter after Grinding Clearance

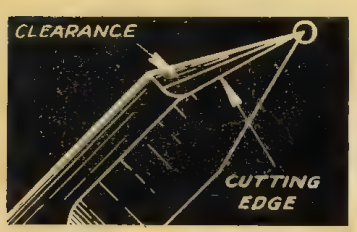


Fig. 9—External View of Fig. 8

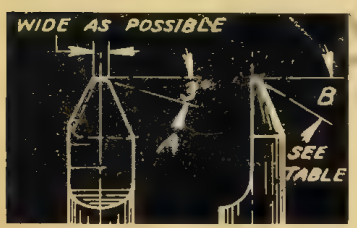


Fig. 10—A "Tipped-off" Cutter

Grinding Chip Clearance — First Operation — Fig. 6

Now feed cutter into face of wheel very gently. Do not rotate, and hold the back (round side) of conical point against wheel. Gradually feed in toward wheel rocking the cutter continuously across face of wheel and without turning, until a flat is ground which runs out *exactly* at the point of cutter, as Fig. 6. Check this very carefully, with a glass if necessary, to be sure you have reached the point with this flat. Be extremely careful not to go beyond. Now you are ready for the final operation.

Grinding Chip Clearance — Second Operation — Figs. 7, 8 and 9.

Now, without turning the feed handwheel any further, rough away stock as Fig. 3, then rotate cutter against face of wheel as Fig. 7, grinding away all stock on back of conical side, *up to* the cutting edge. Be extremely careful at this point not to turn the cutter too far, and thus grind away part of the *cutting edge*. All chatter marks must be cleaned up however and to effect this, it is general practice to remove an additional thousandth of an inch, or so, as necessary, on the cutting edge itself. Watch the point designated by small circle in diagrams. If this *very point* is not correctly ground, the cutter will not work, regardless of how perfect it may be farther out on the taper of cone. A section through the cutter should now be like Fig. 8, and an external view like Fig. 9.

Tipping Off the Cutter Point — Fig. 10

For engraving hair-line letters up to half a thousandth in depth the cutter point is not flattened or "tipped off." For all ordinary work however, it is best to flatten this point as much as the work will permit, as it is very difficult to retain a keen edge with such a fine point, and when the point breaks down, the cutter immediately fails to cut cleanly. Tipping off is usually done by holding the cutter in the hands at the proper inclination from face of grinding wheel, and touching it very lightly against the wheel, or by dressing with an oil stone as explained below. The angle "A" (Fig. 10) should be approximately 3 degrees. This causes the cutter to bite into the work like a drill, when fed down. The angle "B" (Fig. 10) varies depending on the material to be machined with the cutter. The following table will serve as a guide in maintaining this angle "B."

Rake Angle Table for All Single Flute Cutters

Material to be Cut	*Angle B-Fig. 10*
Tool steel	5-10 degrees
Machine steel	10-15 degrees
Hard Brass	15-20 degrees
Aluminum	20-25 degrees
Bakelite, Celluloid, Wood, Fibre	20-25 degrees

Caution

In all finish grinding operations extreme care should be taken not to anneal (burn) the cutting edge. This can be done by (1) Feeding too fast into the wheel, (2) Removing too much stock at a pass, (3) Holding cutter continuously against the wheel, (4) Failure to keep the wheel true and clean as recommended on page 34. The tool head is arranged to rock back and forth across the wheel so as to provide interrupted grinding cuts, thus giving the cutter a chance to cool.

Stoning Small Cutters

The tipped off point of cutter (Fig. 10) can be dressed to size and proper angle, with an oilstone. This can also be done to advantage on the cutting edge and also the flat, but we do not recommend stoning these as it is very difficult to duplicate the angles obtained in the grinder, with the cutter held by hand on an oilstone. Our experience on cutters returned to us for regrinding has proven that cutters are very frequently spoiled by stoning. For this reason we recommend that the cutter be finished entirely on the grinder (except for dressing the tipped-off point as explained above) unless the stoning is done by an expert who is thoroughly familiar with the job. If stoning is attempted, be sure to keep the flat square. It is very easy to stone a cutter down below the point so it will not cut.

Grinding Square Nose Single Flute Cutters — Fig. 11

When square nose single flute cutters are ground they should always be tipped off as explained on opposite page, Fig. 10, unless all the cutting will be done with the side of cutter, in which case the end will not matter. All straight side (square nose), cutters have, of course, clearance ground on the cutting edge as explained above and illustrated in Figs. 7 and 8. After grinding the flat to center (which is very easily checked with this style cutter by using a micrometer) clearance is ground by feeding in the required amount toward wheel and turning the cutter until all stock has been removed from the back (round side) right up to the cutting edge, as Figs. 7 and 8. A table of recommended clearances for various diameter Square Nose cutters is given below.

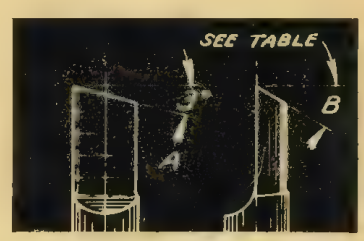


Fig. 11—Square Nose Cutter with Properly Ground Tip

Chip Clearance Table for Square Nose Cutters

Cutter Dia.	Clearance	Cutter Dia.	Clearance
1/10"	.004"	1/4"	.010"
1/8"	.006"	5/16"	.012"
5/32"	.006"	3/8"	.015"
3/16"	.008"	7/16"	.015"
		1/2"	.020"

Example: To grind clearance on a 1/10" dia. Square Nose cutter. Grind the flat as outlined above. Then feed back (round side) of cutter against wheel until it just touches. Then feed in .004" and rotate cutter so as to grind away all material except cutting edge.

Ball Nose Cutters — Figs. 12, 13 and 14

Gorton 375-2 Grinder with 717-1 Tool Head is designed especially for grinding ball nose cutters. To grind, proceed as follows:

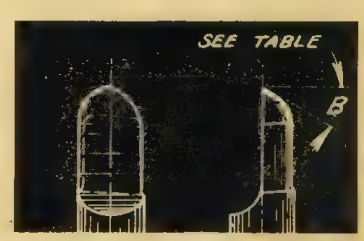


Fig. 12—Properly Ground Ball Nose Cutter

Grinding Chip Clearance on Straight or Tapered Side

Set up in tool head and rough and finish grind for chip clearance and cutting edge as explained above for Square Nose cutters (if the ball nose cutter is to have straight sides like Fig. 12) — or as explained above for Conical point cutters, if the cutter is to have a conical side as in Fig. 14.

Grinding Flat to Center

Before rough grinding the ball nose, be careful to see that the flat is ground exactly to center as explained previously for square nose cutters.

Rough Grinding Chip Clearance on Ball Nose

Tilt the collet tool head to the correct angle in degrees, setting to the Rake Angle Scale, (see "W," page 31) and using the tables for clearance angle "B" Fig. 12 recommended for cutters to be used on materials listed there. We find that 10 degrees is suitable for nearly all kinds of work and all but the very softest materials.

Now insert cutter in collet, using the gauge No. 9839 which fits on flat surface of tool head and is beveled at proper angle for setting all size cutters. With the cutter set by gauge, lock from turning by means of the index pin.

When the cutter and tool head are adjusted for rake and clearance angles, it is necessary to set the collet spindle off center to obtain a perfect radius. This is accomplished by loosening stop screw "U" (Drwg. 9886, page 32) one-half turn and turning the knurled micrometer hand wheel to the *left* approximately .004" for every ⅛" of cutter diameter. To relocate spindle on center, turn stop screw back one-half turn to its original position with handwheel set at zero.

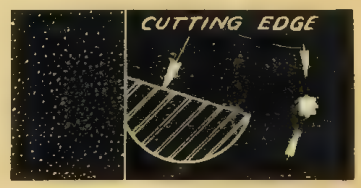


Fig. 13—Tilting Ball Nose Cutter for Clearance

**Use Gauge 9839*

IMPORTANT

For grinding a corner radius on a cutter, proceed as follows: Subtract radius desired plus .004" for every ⅛" of cutter diameter from ½ the diameter of the cutter and turn the knurled handwheel to the right by the amount of the difference. All settings are from zero line when spindle is on center.

With cutter locked, bring it parallel to and just clearing the grinding wheel, then feed into wheel using longitudinal feed handwheel on base of machine. Now swing head at right angles to wheel, feed cutter in until it touches wheel, using knurled micrometer handwheel X, page 31. Now swing head through an arc of 90 degrees until radius is formed on cutter blank, using stops to provide 90 degrees movement for blending ball into side of cutter.

Now release index pin. Rotate collet spindle back and forth, about one-half turn, being careful to keep slightly away from cutting edge. While rotating spindle, swing the tool head through an arc each time spindle is turned. About ten swings of head should rough grind the surface.

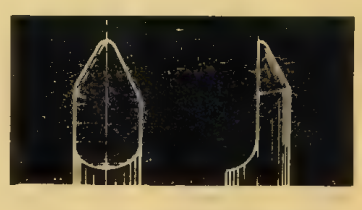


Fig. 14—Ball Nose Cutter with Conical Side

GRINDING THREE and FOUR SIDED CUTTERS

Fig. 15—3-Sided Cutter

FINISH GRINDING CHIP CLEARANCE ON BALL NOSE

Now feed cutter toward wheel with knurled micrometer handwheel X, page 31, exactly the amount of clearance in thousandths called for in table page 34. Swing the tool head back and forth, using stop Y, page 31 to limit travel on cutting edge side, until approximate center of ball is reached.

GRINDING THREE AND FOUR SIDED CUTTERS — Fig. 15

Three or four sided cutters are sometimes used for cutting small steel stamps and other small engraving. They produce a very smooth finish. The index plate on collet spindle of grinder tool head has index holes numbered 3, 4 etc. — for indexing to grind three and four sides. To do this two operations are necessary, as follows:

GRINDING ANGLES OF CUTTING EDGE

Set tool head to angle desired. Then plug pin in index hole for desired number of divisions, and grind flats.

GRINDING CLEARANCE ANGLE

Now without loosening the cutter in collet of tool head, reset the tool head to the proper clearance angle as table below. For example: you are grinding a 3 sided cutter to 45 degrees cutting edge. Referring to the table gives 26½ degrees clearance. Set tool head to 26½ degrees and grind each flat exactly to the point. Do not loosen cutter in collet or change index settings from those used when grinding the 45 degree edge.

CUTTING EDGE ANGLE

Table of Clearance Angles for 3 and 4 Sided Cutters (in degrees)
(Angle of Cut = 2 Times Cutting Edge Angle)

Degrees of Cutting		45	40	35	30	25	20	15	10	5
Angle of Clearance Degrees	3 Sides	26½	23	19½	16	13	10½	7½	5	2½
	4 Sides	35½	30	25½	22½	18½	14½	10	7	3½

7 WAYS TO INSURE PROPER CUTTER PERFORMANCE

1. Keep your cutters sharp.
2. A clean collet or spindle taper will help prevent cutters from running out of true.
3. Check spindles worn in tapers, collet holes or bearings. Excessive wear at these points causes Cutter trouble.
4. Feed fine small cutters much slower than a larger cutter.
5. Be careful to feed cutters in proportion to their strength of material to avoid breakage.
6. Cutters may break or dull from defective steel or wrong temper, but all breakage troubles are not from that cause.
7. Light Cutter Spindle Belts are recommended for extremely delicate work. These endless linen belts are lighter and operate the cutter spindle smoother and with less vibration. We can furnish these belts at slightly higher cost than standard belts.

GRINDING CUTTERS WITH ATTACHMENT 288-1 ON PANTOGRAPH MACHINES

Grinding Cutter with Attachment 288-1

First: Insert Pantograph style into hole in copy holder. This holds cutter head rigid. If cutter head is equipped with depth gauge, loosen foot nut and swing foot outward. Now insert grinding wheel and bolt cutter holder base in place, with cutter point at inside edge of wheel, all as photo at lower left.

Remove cutter holder by lifting spring slightly and insert cutter tightly, using small wrench. Replace cutter holder and grind cutter point to the proper angle by revolving cutter and shifting table with cross slides.

With cutter pointed as desired, it must be ground for clearance, as shown on Fig. 7, page 35, which means grinding away the metal back of cutting edge so that cutter will cut free and raise no burr on work. To grind this clearance, table must be shifted slightly so that wheel will grind above the cutter point.

By rotating cutter (half turn) back and forth, clearance can be ground without actually grinding the point and cutting edge more than just enough to bring it to a sharp edge. Remove point slightly with a fine oilstone.

SUGGESTIONS ON OPERATION OF CUTTERS

Grinding Very Fine Cutter Points

Most of the difficulties experienced when using extremely small cutters on small lettering in dies and stamps are caused by improper grinding. This applies especially to the *very cutter point* where possibly only .01" of the point is used.

Grinding a Spiral Flute Cutter on 375-2 Cutter Grinder with 717-1 Universal Tool Head

This very *point* therefore, is the part that *must* be accurately sharpened. If the actual *point* is not perfect, a cutter that may be beautifully ground in all other respects is simply no good for doing the work. Examine the point with a good magnifying glass, and do not try to use the cutter until you are satisfied that it is in perfect condition for doing the kind of work you have a right to expect of it. When trouble is experienced, usually the point is *burned*, or the flat is either *too high* or *too low*. Perhaps the clearance does not run clear out to the *point*. Sometimes stoning off the flat with a small fine oil stone will make the cutting edge keener.

The *only* way by which a cutter point can be made to run *absolutely perfect*, is by sharpening in the cutter spindle in which it runs. Most Gorton machines have provision for removing the cutter spindle from the machine and placing in a V block Tool Head on the Cutter grinder. The cutter is then ground to the conventional shape just as previously explained, all without removing it from the cutter spindle. We find this procedure unnecessary for any but the very finest type and steel stamp work, however. For such small, fine sunk letters 1/32" to 1/16" high and say, .005" to .015" depth of cut, grind the cutter in place in the spindle of the machine to an angle of about 25 degrees. Trace the copy *evenly* and *steadily* as a sudden jerk will be almost certain to break off the cutter point. A correctly ground cutter should engrave from 30 to 50 characters this size in annealed tool steel before resharpening.

Operation of Cutters—General

After the cutter has been placed in operation, it must be kept sharp and with proper clearance at all times. This is particularly important when running at extremely high speed as a dull cutter burns quickly. If the cutter raises a burr, it is pretty certain to be dull or without clearance, or both. Cutters will not always cut the same kind of material with equal facility as materials vary in density and hardness, even in the same piece.

A dirty or worn collet may cause a cutter to run out of true. Loose or badly worn spindle bearings will frequently cause the cutter to break.

Gorton Taper Shank Cutters

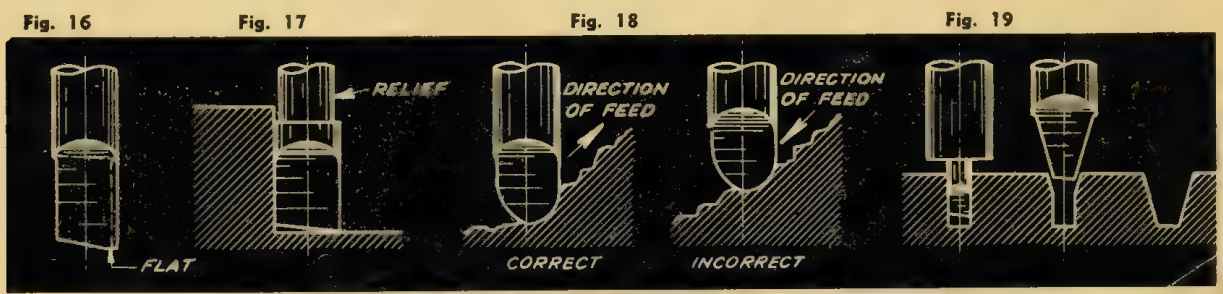
Wring the cutter (if taper shank) in the spindle very tight. Do not continue with a cutter if it comes loose, or the spindle will be worn so that no cutter can be held properly. If this happens; check taper of cutter in spindle by rubbing on a little Prussian blue. The cutter should fit more tightly at small end than large. If the blue shows otherwise, and the spindle is old, it is probably worn out of true and needs replacing.

Fig. 16 — Stoning a very slight flat on the point of the cutting edge of a square nose single flute cutter will make it produce a smoother finish, especially in cutting brass.

Fig. 17 — Vertical sides of considerable depth can be milled faster and more accurately if the cutter be relieved as shown, to the same depth as for chip clearance back of the cutting edge.

Fig. 18 — In milling irregular contours, etc., faster cutting will be done if the direction of feed is upward as shown, instead of down.

Fig. 19 — For milling narrow taper slots, best results will be obtained by grinding a cutter to the full bottom width of the slot and cutting this the full depth as shown at left. The taper sides are then milled out using a taper cutter.



CUTTER SPEED CHART

Revolutions per minute for High Speed Steel Cutters, single flute type.
Use two-thirds of speeds shown for 2 and 4, one-half speeds for 6 flute end mills.

Cutter Diameter (at cutting point)	1/32"	1/16"	1/8"	3/16"	1/4"	5/16"	3/8"	7/16"	1/2"
Hard Wood *(650-800 Ft. per Min.)*	10,000 to 20,000	Ditto	Ditto	Ditto	Ditto	9,000	8,000	7,000	6,000
*Bakelite *(170-250 Ft. per Min.)*....	10,000	8,000	6,000	4,000	3,000	2,200	1,800	1,500	1,300
†Engraver's Brass and Aluminum *(375-425 Ft. per Min.)*	10,000 to 15,000	10,000 to 15,000	10,000 to 15,000	8,000	6,000	5,000	4,000	3,500	3,000
Cast Iron *(130-250 Ft. per Min.)*....	8,000	7,500	5,500	3,500	2,500	2,000	1,650	1,400	1,200
Hard Bronze and Machine Steel.... *(80-200 Ft. per Min.)*	7,000	6,000	3,000	2,200	1,600	1,200	975	800	700
Annealed Tool Steel ..... *(70-100 Ft. per Min.)*	5,000	4,500	2,300	1,600	1,200	1,000	850	725	600
Stainless, Monel, Etc. ..... *(45-75 Ft. per Min.)*	3,500	2,750	1,400	1,050	700	575	500	435	350
Very Hard Die and Alloy Steels... *(30-45 Ft. per Min.)*	2,000	1,250	800	600	475	400	350	300	250

*Also celluloid, hard rubber, pearl, ivory and synthetic plastics.

Tungsten or Tantalum carbide cutters can be run at much higher speeds on wood, Bakelite, brass, aluminum, and cast iron than given in table. They are not recommended in these small sizes, for harder materials.

†Slightly lower speeds for ordinary brass, zinc, copper, silver, gold, soft bronze, German silver.

Diamond cutters—same speeds for all materials as for cutting in brass with steel cutters.

USING THE CHART

The speeds worked out on the chart above are the result of our own experience over a period of years, coupled with what is considered good modern practice. In using the chart it must be kept in mind that the speeds recommended will vary greatly, depending on the depth of cut, and particularly the rate at which the cutter is fed through the work. Since Gorton machines are fed manually the rate of feed is subject to a wide variation in the hands of individual operators, which will in many cases affect the spindle speeds used. The experienced operator will have found by trial the speeds and feeds best suited to his own work and for him this chart is only a means of comparison. It will be found invaluable however, for the inexperienced operator or persons not familiar with the operation of the small, high speed cutters used in Gorton machines.

ROUGHING CUTS

Considerable latitude has been given in the recommended Ft. per Min. cutting speeds listed after the various materials. In most instances the minimum Ft. per Min. speeds were used for calculating the RPM given on the chart. Consequently these chart speeds may be used for most medium roughing cuts. For a very heavy roughing cut, where considerable stock is removed, it may be necessary to use slower speeds than the chart. For these cuts much depends on the rate at which cutter is fed through the work. For any given depth of cut the speed must be decreased as the feed is increased.

FINISHING CUTS

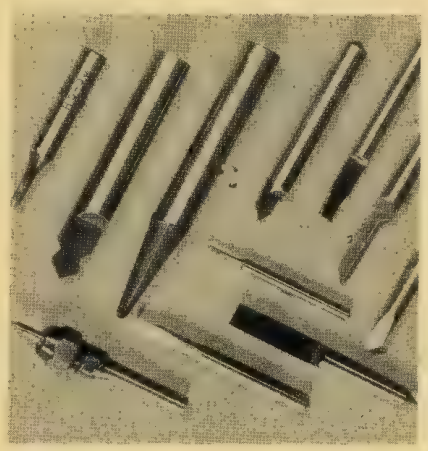
Considerably higher speeds than given on the chart may be used for finishing cuts where a very slight amount of stock is removed. Take for instance the chart speeds for cutting cast iron. These are based on the lowest, 130 Ft. per Min. rate and are intended for use in taking roughing cuts. For finishing in some instances, the rate of 250 Ft. per Min. might be used, which would mean speeds almost double those given on the chart.

HELPFUL SUGGESTIONS

With all Pantographs and Duplicators, run cutters at highest speeds possible, and remove stock with several light, fast cuts rather than one heavy cut at slower spindle speeds. Always use the highest speed possible without burning the cutter. In cutting steel, and all hard materials, start with a slow speed and work up to the fastest which cutter will stand without losing its cutting edge. Sometimes it may be advisable to sacrifice cutter life in order to obtain the smoother finish possible at higher speeds. With a little experience, the operator can feel when the cutter is running at maximum efficiency.

Cutter Steels

For average work in steel, cast iron, brass and other similar materials, the best cutting tools we have found are high speed steel. For cutting in other materials besides those specified below, see Gorton Accessories Catalog.



Sample Cutters Used on Gorton Pantograph Machines

Cutters of New Hard Alloys

We have tested the new hard alloy cutters known by trade names such as Carboloy, Widia, Ramet, etc., and recommend them very highly for cutting soft abrasive materials like Bakelite, hard rubber, celluloid and all other synthetic plastics. On these materials such cutters have 15 to 20 times greater life between grinds than the best high speed steels. On tests we have cut the equivalent of 50,000 letters ⅛" high in Bakelite panels without regrinding cutter, and without the cutter showing appreciable wear. On rubber rolls we have used similar cutters for 50 hours without regrinding. For all this work we list in Gorton Accessories Catalog, Carboloy blanks for insertion in 21-2, 22-4 collets (listed in Gorton Accessories Catalog) also larger dia. blanks for holding in regular collets, and inserted Carboloy tipped Cutters.

Characteristics of New Hard Alloys

These cutters are not suited, however, to work requiring frequent grinding of tip to various angles and clearances, since they are almost as hard as a diamond and require special wheels for grinding. These cutter materials are formed of very hard small grains held together by a bond. On account of this granular structure it is almost impossible to grind such cutters to a fine, keen point for the very finest line engraving, but points small enough for engraving 3/32" and 1/8" high characters can be maintained. We have special equipment for grinding these cutters and can supply any angle and clearance, or customer can grind them (see Grinding, page 34).

Ordering New Hard Alloys

These new hard alloys are made in a great many different grades and hardnesses for every condition of service. In ordering such cutters, it is necessary to state the materials desired to cut, and general information regarding operating conditions, to insure receiving correct grade and type.

Diamond Cutters

For engraving lettering on glass and hardened steel, diamond cutters can be furnished, see Gorton Accessories Catalog. They will engrave a line .003" to .005" deep. They are run at 10,000 R.P.M. or more.

Cutting Lubricants

For all grades of steels shown on the chart, page 39, any good cutting oil or mineral lard oil is best, although it is not always necessary to use a lubricant with small cutters. These oils can be obtained from such concerns as Socony Vacuum Oil Company, Sun Oil Co., E. F. Houghton, etc. For die work or any purpose requiring maximum visibility at all times use an emulsifying oil or some similar light thin compound rather than a dark, heavy base oil. The heavy base oils cover up the work completely and hinder chip removal, making it difficult for the operator to see what he is doing. For cast iron, Bakelite (and associated materials on chart) also brass, no lubricant is necessary. Houghton's "Fropol" is good for cutting stainless steel and Monel metal, although these new steels are made in over 30 different grades, with greatly varying characteristics.

For fine cutting in aluminum or to avoid burrs, use half lard oil and kerosene, mixed. For engraving glass or hardened steel with a diamond cutter, flood the work with turpentine and do not allow to dry.

For cutting plastics or cast iron with the new hard alloy cutters as Carboloy, Widia, etc., no lubricant is necessary.

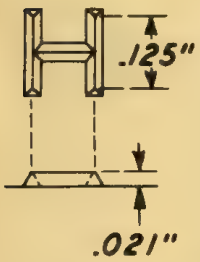
CUTTING STEEL DIES AND STAMPS

Die Steel

A high grade of well annealed tool steel should be used. Very tough steels may be necessary on some stamps intended for severe service, but for most work a freer cutting steel will be just as serviceable and much easier to cut. The time and trouble saved in cutting more than makes up for the higher cost of a good steel. Use enough lubricant to avoid burning the cutters. Single lip cutters cut most freely but 3 or 4 sided cutters are sometimes useful for finishing as they leave a smooth finish.

Proportions of Steel Stamp Letters

A practical way to proportion steel stamps is to make the raised height of stamp about 1/6 of the height of the characters (on the center line). For instance, if the letter is .125" printed height, then the raised height of stamp would be .021". (See diagram.)



For roughing always use the largest diameter tracing style possible. If your tracing style is too large to pass through some portions of the copy, that will make no difference. Raise cutter out of work and pass the style to the next portion of copy where it will trace through, etc. Three sizes of cutters are generally used, the last one for removing only 3 or 4 thousandths of stock. Eighty percent of material is removed with the first cut.

Corners of Letters

Corners can be removed by "stepping up." Set the cutter at half depth when stamp is otherwise finished, and use a tracing style as small as possible without under-cutting.

Recommended Angles for Relief Characters

The taper desired on relief characters will determine the angle to which the cutter is ground. On stamps designed for hard use, such as large, heavy steel stamps, the characters should be cut with a cutter having an angle of 37 to 45 degrees (on a side) on the cutting edge. For light steel stamps, to be used on brass, copper, lead and other soft materials, 25 to 35 degrees will be found strong enough. For stamps to be used on wood, 10 or 15 degrees on the cutting edge is sufficient.

Determining Cutter Angles for Sunk Characters

It may frequently be necessary to engrave sunk characters to a predetermined width of face. To find this, when the angle of cutter is known, simply multiply by the proper tangent, then multiply the result by two (2). Below is a table of tangents. (More complete tables can be found in any Machinist Hand Book.)

CUTTING EDGE ANGLE

Table of Tangents (From Machinery Handbook)	
15°	= .268
17°	= .306
20°	= .364
22° 30′	= .414
25°	= .466
30°	= .577
33°	= .649
35°	= .700
37° 30′	= .767
40°	= .839
42° 30′	= .916
45°	= 1.000

Example	
30°	Cutting Edge
.577	Tangent
x.012	Depth of Cut
1154	
577	
.006924	
x2	Multiply by 2
.013848	Sharp Point
.020	Add Tip Off
.0338	Width of Face

Example: If a 60 degree included angle cutter is being used and depth of cut is .012", multiply the tangent of 30 degrees (.577) by the depth, which will equal .0069". Multiply this by two which will equal .0138", or the face of cut. If the cutter is to be used with the point "tipped off," proceed as above and add the diameter of the cutter tip.

NOTE: The width of face in all cases above is taken at surface of work.

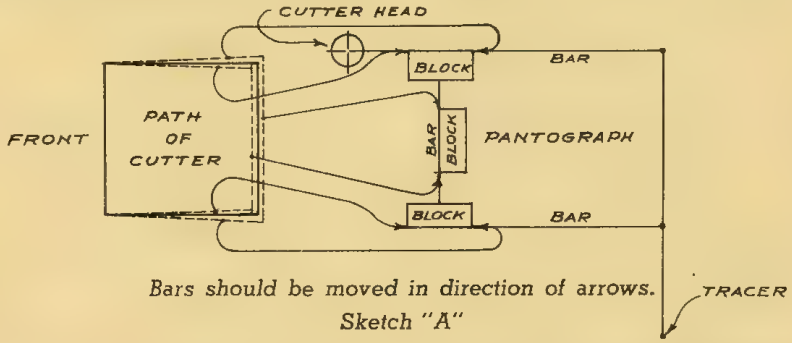
DIRECTIONS FOR ADJUSTING PANTOGRAPH BARS

Before attempting to readjust the setting on any of the Gorton Pantograph machines one should have beyond all doubt a real reason for doing so. The original lines or calibrations are accurately placed on the bars by experts with the use of special gauges and templates. Much time is spent in this operation, and without exception they are held to a very close degree of accuracy. If readjusting is found to be necessary for some reason, the following sketches should be clearly understood. The heavy lines represent the path the cutter spindle should follow, while the dotted lines are the probable paths followed when the Pantograph setting is off. No Pantograph operator should become alarmed if in checking he finds his particular machine to vary a small amount on following a perfect square. This is a characteristic common in the average Pantograph machine and can be only understood fully by engineers well versed in that phase of the work.

We have found it impossible to fully describe in words the procedure usually followed in this work, but after a few moments' study one can easily follow step by step the thoughts that are clearly shown in each sketch. Without the chart it would be difficult to convey this information unless all operators had a great deal of experience in the erection of Pantographs.

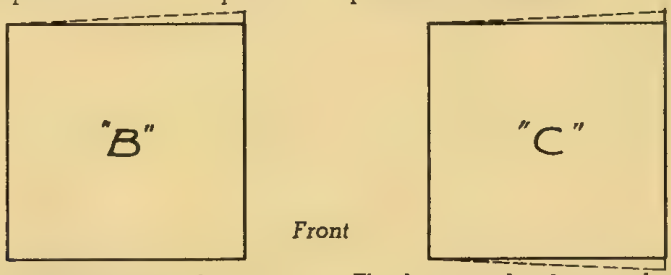
3-S PANTOGRAPH

The arrows on sketch "A" represent the direction the Pantograph bars (not blocks) are to be moved. Loosen the locking nuts just enough to allow the bars to move freely, then slide the bars a very little at a time. Just a few thousandths one way or the other will usually change the setting sufficiently. If the setting is off considerably, good judgment will have to be used so as not to throw the Pantograph setting too far off. Should the setting be off any great extent a good plan is to place a small prick-punch mark on the bars close to the indexing surface of the blocks. This will always allow the operator a common starting point should he become lost in the setting.



Bars should be moved in direction of arrows.
Sketch "A"

After all directions pertaining to Sketch "A" are followed and the cutter point forms a trapezoid instead of a square such as described on Sketch "B", proceed as follows:



By manipulating the four set screws on the outer and under side of the copy holder bracket (spacer between column proper and Pantograph support) the Pantograph mechanism in itself is moved independent of the work table. The four large hexagon head cap screws that hold these three units together must be loosened before adjusting is attempted, and tightened firmly after to insure proper alignment.

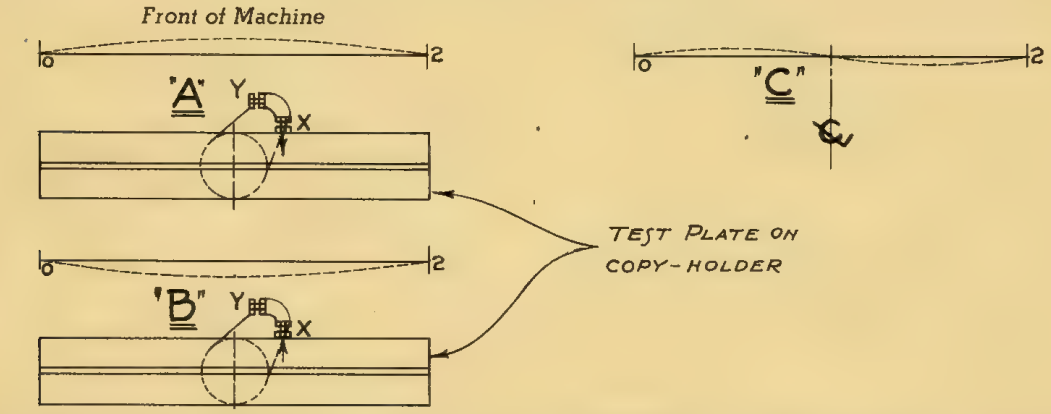
The best results that can be obtained if the setting is as shown on Sketch "B" is to strive for a happy medium as indicated on Sketch "C".

CAUTION

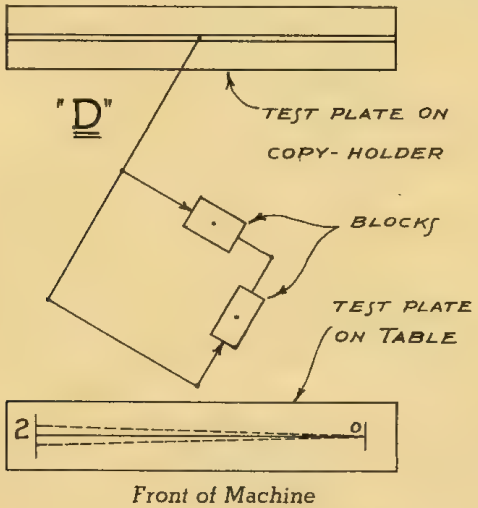
Before attempting to set any Pantograph an accurately ground pointed pin (style, pointer, or checking plug) must be placed in the cutter spindle and checked to insure true running of this part.

INSTRUCTIONS FOR THE SETTING OF PANTOGRAPH HAVING TWO PLACES FOR ADJUSTMENT. (3-U, 3-F, 3-Z, 3-X)

The most common errors to contend with when setting to a straight line is the bow effect as shown in Sketch "A" or "B". To overcome this, adjusting screw (X) should be turned in or out to swing the copy holder around enough to compensate for the bow. It should be remembered before this test is made the cutter point should not overlap or underlap by much, the lines "0" and "2". Sketch "C". If the bow is quite large, the results will be as in Sketch "C" but no apparent way is known to straighten out this line. Do not alter screw "Y" under any circumstance or attempt to adjust screw "X" after it has been adjusted for the first Pantograph setting.



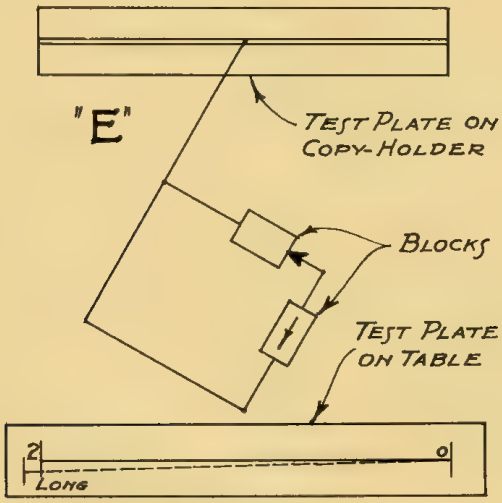
After having adjusted screw (X) for taking out the bow, a condition will arise as shown in Sketch "D". It will be found that the cutter point will just strike "O" and "2" without being long or short. Also refer to Sketch "G" and "H".



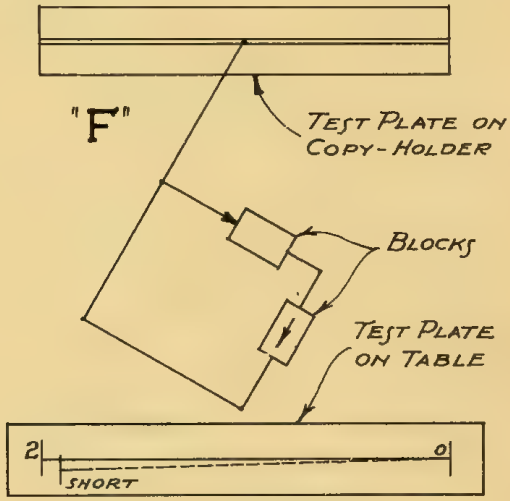
This would also apply if the cutter point was off to the left side of the line, but only refer to Sketch "E" and "F".

INSTRUCTIONS FOR THE SETTING OF PANTOGRAPH HAVING TWO PLACES FOR ADJUSTMENT. (3-U, 3-F, 3-Z, 3-X)

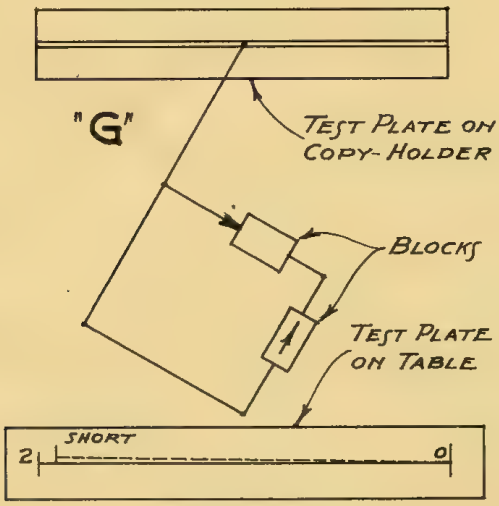
Arrow represents direction block and bar is to be moved. This applies to all sketches.



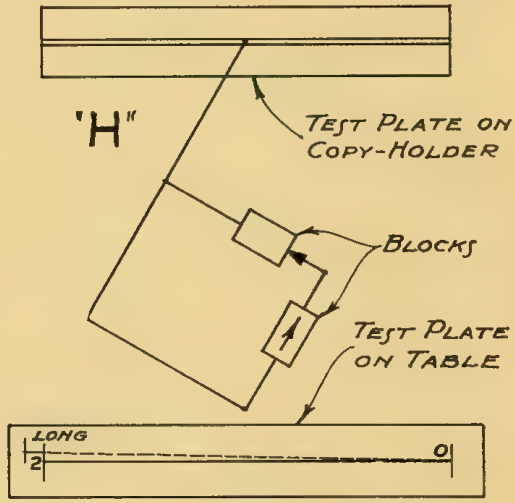
Front of Machine



Front of Machine



Front of Machine

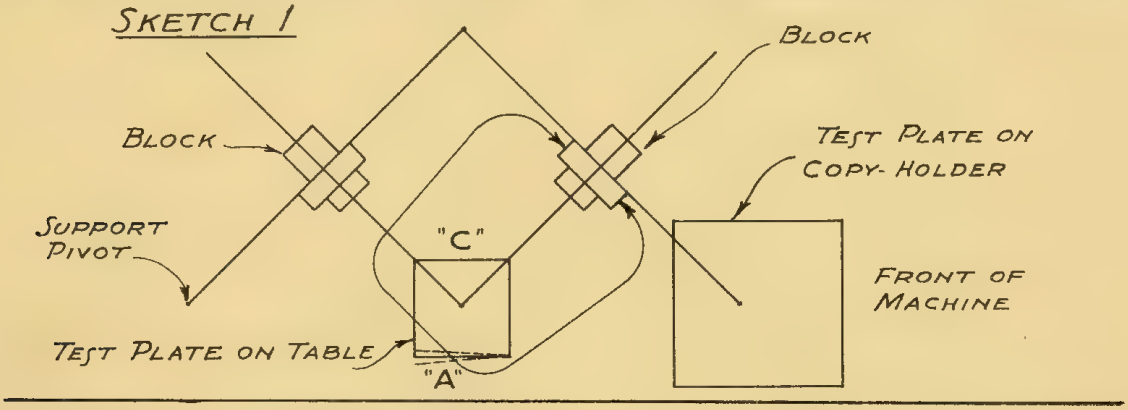


Front of Machine

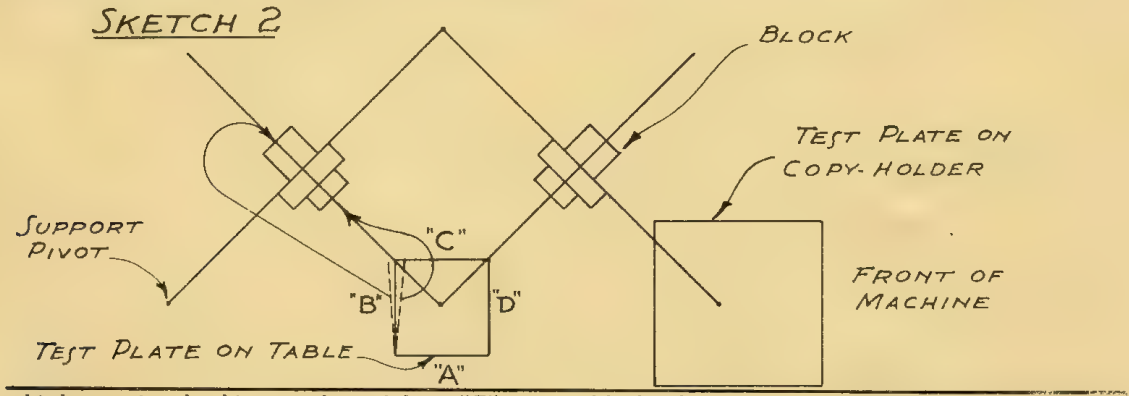
REMARKS—The reason block and bar is mentioned is as follows: When the upper bar is to be adjusted, more freedom is encountered by the sliding of the bar, but when the lower bar is to be adjusted it is handier to move the block. It must be remembered that only a very little movement of the bars or blocks change the setting of the Pantograph, therefore with the use of much discretion good results can be obtained.

DIRECTIONS FOR ADJUSTING 3-L, 3-B PANTOGRAPHS

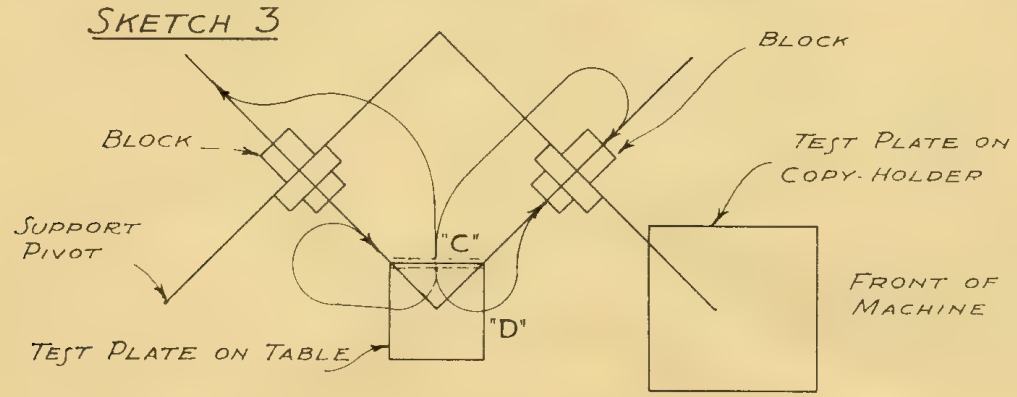
The first step is to place a pointed style in the cutter spindle. Then, check the setting to find out if the pointer follows line "A" beginning with the corner marked "O". If the pointer goes to the left of the line, follow the arrow as in Sketch "1" and move the block in the direction indicated.



The second step is to set the Pantograph to line "B". If it does not track true with the line, move block as described in Sketch "2". After this is completed, recheck line "A" continuing on to line "B" to insure the trueness of both lines.

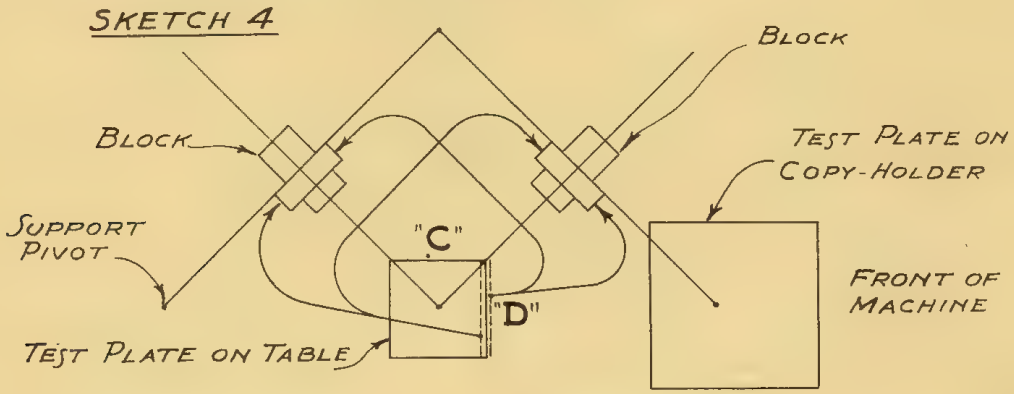


The third step in checking is that of line "C" in Sketch "3". Arrows show which way blocks should be moved to accomplish this setting. Move both blocks the same distance, otherwise the squareness gained in Sketches "A" and "B" will be lost.



DIRECTIONS FOR ADJUSTING 3-L, 3-B PANTOGRAPHS

The fourth step is the checking of line "D" and proceed as shown in Sketch "4". The same caution should be exercised as in the first settings.



GENERAL INFORMATION

When the four steps in setting are followed carefully and a perfect square is not accomplished, a fifth step must be taken. Sketch "2" line "B" must again be attacked. In following this line it might be necessary to adjust the small screws on the copy holder, thereby allowing the holder to swing just enough to have the checking pointer run true with line "B". After this fifth step one must again start from the beginning to be sure of the required accuracy.

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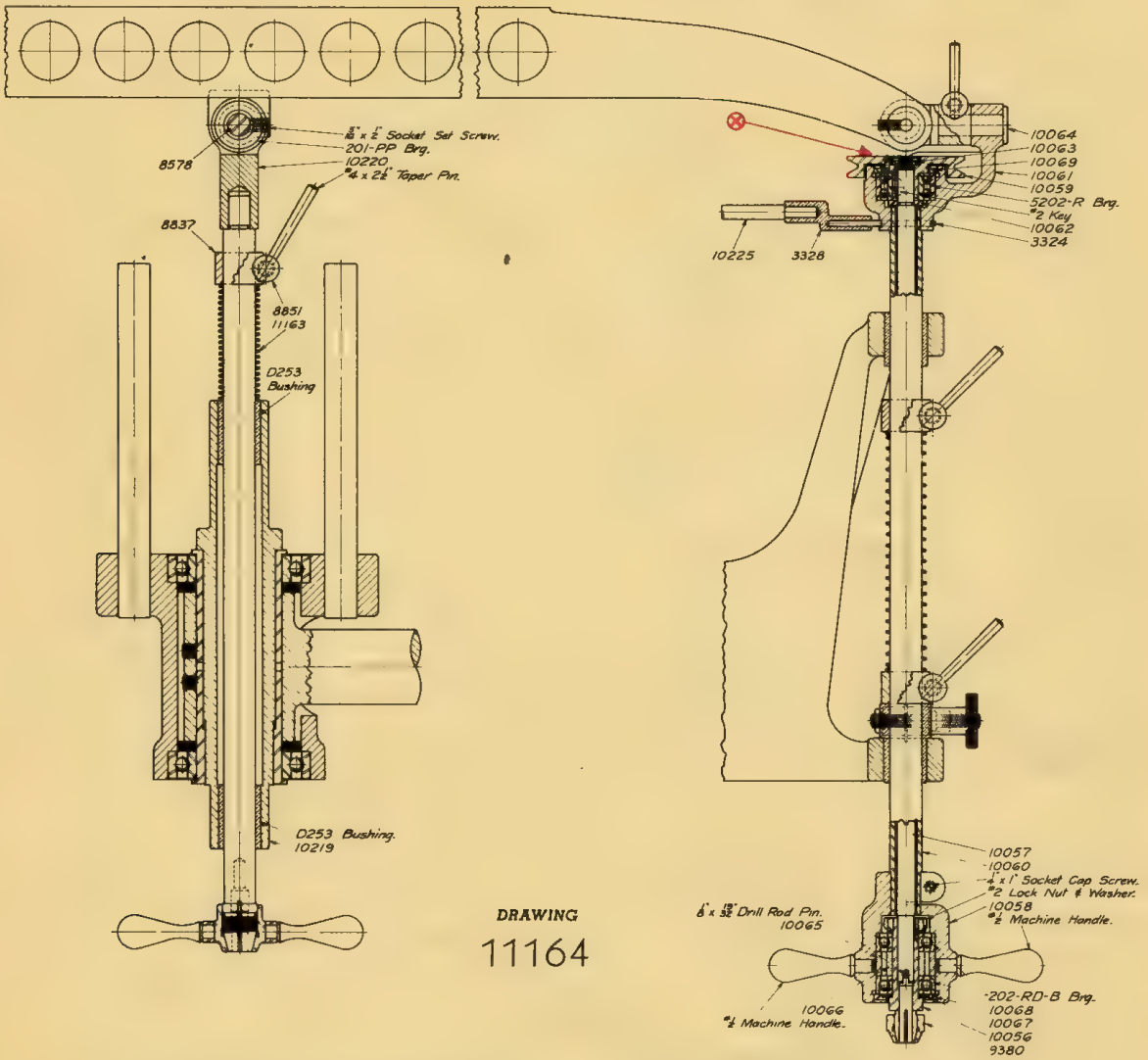
ENLARGING SPINDLE 804-1 *For 3-L Machine*

To mount Enlarging Spindle 804-1 on 3-L machine first remove modelling bar, belt tension rod, cutter spindle (by unscrewing), and spindle yoke. Next place large bushings, furnished with attachment, in former position of spindle, inserting from the top. Remove the tracer spindle from its normal position and mount in large bushing, locking smaller roller yoke to top of tracer spindle and using special spring furnished with assembly to balance spindle. Tension on this spring may be adjusted with clamp collar placed on spindle above spring.

Assemble auxiliary cutter spindle in former tracer position and use tracer spring and clamp bushings to balance. Replace belt tension rod with long one furnished, attaching to auxiliary spindle, and replace modelling bar. Unit is now ready for operation and requires only that Pantograph bars be set for the desired enlargement. We do not recommend using enlargements greater than two or three. Enlargement settings are exactly the same as for reductions when machine is used in its normal operation.

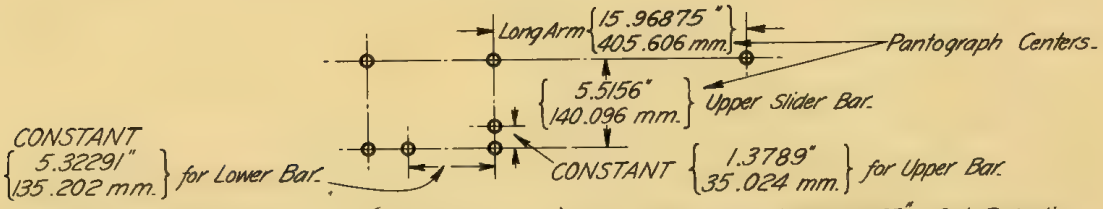


IMPORTANT — When ordering REPAIR PARTS, give serial number of machine found on pad at top of slider head.	**SCHEDULE FOR LUBRICATION**
	⊗ Use spindle oil twice a day.

FORMULA FOR OBTAINING SPECIAL REDUCTIONS

ON ENGRAVING MACHINES, NUMBERS { 1A, 1G, 1H, 3A, 3G, 3H, 3F, 3X.

LEAST REDUCTION POSSIBLE 3 TO 1. GREATEST REDUCTION POSSIBLE 100 TO 1 and Finer to 0-0



Upper Bar Constant = 5.5156" ÷ 4 (3rd. Reduction + 1). Lower Bar Constant = 15.96875" ÷ 3rd Reduction.

EXAMPLE: REQUIRED THE SETTINGS IN INCHES FOR REDUCING 5.3 TO 1.

For LOWER Slider Bar

Required Reduction 5.3) 15.96875" (5.3229" ← Lower Bar Constant
159 — 3.0129"
68 — 2.3100"
53
157
106
515
477
38

Long Arm Centers. ← 159 ; Subtract from ← 3.0129"

Distance to set Index Edge on Lower Slider Bar Head from Graduation 3. See below sketch.

For UPPER Slider Bar

First divide the Upper Slider Bar Center distance 5.5156," by the Reduction Required plus a Constant of 1.

1.0 + Reduction Required 5.3 = 6.3

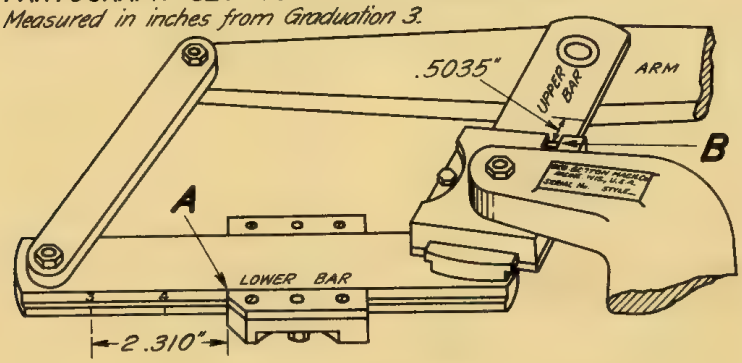
6.3) 5.51560" (0.8754"
5 04 — 0.5035"
475
441
346
315
310
252
58

Upper Slider Bar Centers. ← 5.51560" ; Upper Bar Constant 1.3789" ; Subtract from ← 0.8754"

Distance to set Index Edge on Upper Slider Bar Head from Graduation 3. See below sketch.

PANTOGRAPH SET TO THE 5.3 REDUCTION

Measured in inches from Graduation 3.



To set the Pantograph for any desired Special Scale of Reduction as per above Formula or as per Schedule of various Reductions given: Place the Bevelled Index Edges of the Sliders away from the Lines marked 3 on the Bars, the Distances required. THUS. As shown in the Sketch for the Reduction 5.3 the Lower Bar Slider must be set as at "A" 2.310" from the Line 3, and the Upper Bar Slider as at "B" .5035" from its Line 3.

FORM 990-A

REDUCTION SCHEDULES in INCHES and MILLIMETERS

FORM 993-A

SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS. 1C, 3C, SPECIAL PANTOGRAPH, TOOL NUMBER 55-1.

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES
1.0	0.000	0.000
1.1	0.544	0.131
1.2	0.997	0.251
1.3	1.381	0.360
1.4	1.710	0.460
1.5	1.995	0.552
1.6	2.244	0.636
1.7	2.464	0.715
1.8	2.660	0.788
1.9	2.835	0.856
2.0	2.992	0.919
2.1	3.135	0.979
2.2	3.265	1.034
2.3	3.383	1.086
2.4	3.491	1.136
2.5	3.591	1.182
2.6	3.683	1.226
2.7	3.768	1.267
2.8	3.847	1.306
2.9	3.921	1.344
3.0	3.990	1.379

FORM 994-A

SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS. 1C, 3C, SPECIAL PANTOGRAPH, TOOL NUMBER 55-1.

REDUCTION	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
1.0	00.00	0.00
1.1	13.82	3.34
1.2	25.34	6.37
1.3	35.08	9.14
1.4	43.43	11.67
1.5	50.67	14.01
1.6	57.01	16.16
1.7	62.60	18.16
1.8	67.56	20.01
1.9	72.01	21.74
2.0	76.01	23.35
2.1	79.63	24.86
2.2	82.92	26.27
2.3	85.92	27.59
2.4	88.68	28.84
2.5	91.21	30.02
2.6	93.55	31.13
2.7	95.72	32.18
2.8	97.73	33.18
2.9	99.60	34.13
3.0	101.35	35.02

FORM 947-A

SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS. 1A, 1G, 1H. 3A, 3G, 3H, 3F, 3X.

REDUCTION	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
3.0	0.00	0.00
3.1	4.36	0.85
3.2	8.45	1.67
3.3	12.29	2.44
3.4	15.91	3.18
3.5	19.31	3.89
3.6	22.53	4.57
3.7	25.58	5.22
3.8	28.46	5.84
3.9	31.20	6.43
4.0	33.80	7.00
4.1	36.27	7.55
4.2	38.63	8.08
4.3	40.88	8.59
4.4	43.02	9.08
4.5	45.07	9.55
4.6	47.03	10.01
4.7	48.90	10.45
4.8	50.70	10.87
4.9	52.43	11.28
5.0	54.08	11.67
5.1	55.67	12.06
5.2	57.20	12.43
5.3	58.67	12.79
5.4	60.09	13.13
5.5	61.46	13.47
5.6	62.77	13.80
5.7	64.04	14.11
5.8	65.27	14.42
5.9	66.46	14.72
6.0	67.60	15.01
6.1	68.71	15.29
6.2	69.78	15.57
6.3	70.82	15.83
6.4	71.83	16.09
6.5	72.80	16.34
6.6	73.75	16.59
6.7	74.66	16.83
6.8	75.55	17.06
6.9	76.42	17.29
7.0	77.26	17.51
7.2	78.87	17.94
7.4	80.39	18.35
7.6	81.83	18.73
7.8	83.20	19.10
8.0	84.50	19.46
8.2	85.74	19.80
8.4	86.92	20.12
8.6	88.04	20.43
8.8	89.11	20.73
9.00	90.13	21.01
9.25	91.35	21.36
9.50	92.51	21.68
9.75	93.60	21.99
10.00	94.64	22.29
10.50	96.57	22.84
11.00	98.33	23.35
11.50	99.93	23.82
12.00	101.40	24.25
12.50	102.75	24.65
13.00	104.00	25.02
14.00	106.23	25.68
15.00	108.16	26.27
16.00	109.85	26.78
18.00	112.67	27.65
20.00	114.92	28.35
22.00	116.77	28.93
24.00	118.30	29.42
26.00	119.60	29.84
28.00	120.72	30.19
30.00	121.68	30.50

FORM 948-A

SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS. 1A, 1G, 1H. 3A, 3G, 3H, 3F, 3X.

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES
3.0	0.000	0.000
3.1	0.172	0.034
3.2	0.333	0.066
3.3	0.484	0.096
3.4	0.626	0.126
3.5	0.760	0.153
3.6	0.887	0.180
3.7	1.007	0.205
3.8	1.121	0.230
3.9	1.228	0.253
4.0	1.331	0.276
4.1	1.428	0.297
4.2	1.521	0.318
4.3	1.609	0.338
4.4	1.694	0.357
4.5	1.774	0.376
4.6	1.851	0.394
4.7	1.925	0.411
4.8	1.996	0.428
4.9	2.064	0.444
5.0	2.129	0.460
5.1	2.192	0.475
5.2	2.252	0.489
5.3	2.310	0.503
5.4	2.366	0.517
5.5	2.419	0.530
5.6	2.471	0.543
5.7	2.521	0.556
5.8	2.570	0.568
5.9	2.616	0.580
6.0	2.661	0.591
6.1	2.705	0.602
6.2	2.747	0.613
6.3	2.788	0.623
6.4	2.828	0.634
6.5	2.866	0.643
6.6	2.903	0.653
6.7	2.939	0.663
6.8	2.975	0.672
6.9	3.009	0.681
7.0	3.042	0.689
7.2	3.105	0.706
7.4	3.165	0.722
7.6	3.222	0.738
7.8	3.276	0.752
8.0	3.327	0.766
8.2	3.375	0.779
8.4	3.422	0.792
8.6	3.466	0.804
8.8	3.508	0.816
9.00	3.549	0.827
9.25	3.597	0.841
9.50	3.642	0.854
9.75	3.685	0.866
10.00	3.726	0.877
10.50	3.802	0.899
11.00	3.871	0.919
11.50	3.934	0.938
12.00	3.992	0.955
12.50	4.045	0.970
13.00	4.095	0.985
14.00	4.182	1.011
15.00	4.258	1.034
16.00	4.325	1.054
18.00	4.436	1.089
20.00	4.524	1.116
22.00	4.597	1.139
24.00	4.658	1.158
26.00	4.709	1.175
28.00	4.753	1.189
30.00	4.791	1.201

FORMULA FOR OBTAINING SPECIAL REDUCTIONS

REG U S PAT OFF TRADE MARK GORTON RACINE, WIS., U.S.A.

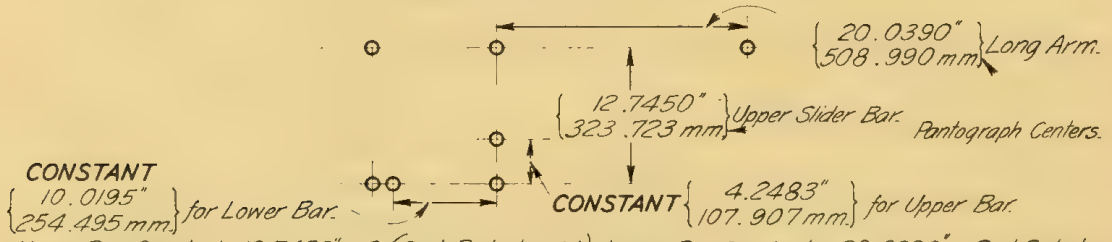
ON ENGRAVING MACHINES, NUMBERS { 1D, 1J. / 3D, 3J, 3U, 3Z.

LEAST REDUCTION POSSIBLE
1D, 1J, 3D, 3J = 2 TO 1.
3U, 3Z = 1 TO 1.

GREATEST REDUCTION POSSIBLE
1D, 1J, 3D, 3J, 3Z = 16 TO 1.
3U = 40 TO 1.

GEO. GORTON MACHINE COMPANY

RACINE, WIS., U.S.A.



Upper Bar Constant = 12.7450" ÷ 3 (2nd. Reduction + 1). Lower Bar Constant = 20.0390" ÷ 2nd Reduction

EXAMPLE: REQUIRED THE SETTINGS IN INCHES FOR REDUCING 4 TO 1.

For LOWER Slider Bar.

Required Reduction → 4.0) 20.0390" / 5.0097"

Long Arm Centers.

Lower Bar Constant → 10.0195"

Subtract from → 5.0097"

5.0098"

Distance to set Index Edge on Lower Slider Bar Head from Graduation 2. See below sketch.

For UPPER Slider Bar.

First divide the Upper Slider Bar Center distance 12.7450" by the Reduction Required plus a constant of 1.

→ 1.0 Upper Slider Bar Centers.

Reduction Required → 4.0 / 5.0) 12.7450" / 2.5489"

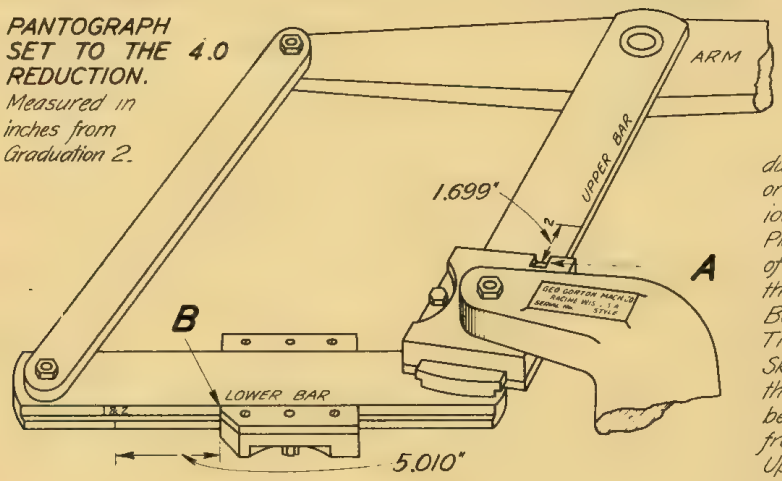
Subtract from → 4.2483" ← Upper Bar Constant.

→ 2.5489"

Distance → 1.6994"

to set Index Edge on Upper Slider Bar Head from Graduation 2. See below sketch.

PANTOGRAPH SET TO THE 4.0 REDUCTION.
Measured in inches from Graduation 2.



To set the Pantograph for any desired Special Scale of Reduction as per above Formula or as per Schedule of various Reductions given. Place the Bevelled Index Edges of the Sliders away from the Lines marked 2 on the Bars, the Distances required: THUS – As shown in the Sketch for the Reduction 4.0 the Lower Slider Block must be set as at "B" 5.010" from the Line 2 and the Upper Slider Block as at "A" 1.699" from its Line 2.

FORM 987-B

GORTON
REG U.S. PAT. OFF. TRADE MARK
RACINE, WIS., U.S.A.

REDUCTION SCHEDULES in INCHES and MILLIMETERS

FORM 988-A
SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS.
1D, 1J.
3D, 3J, 3U, 3Z.

REDUCTION	LOWER BAR INCHES	UPPER BAR INCHES
2.0	0.000	0.000
2.1	0.477	0.137
2.2	0.911	0.265
2.3	1.307	0.386
2.4	1.670	0.500
2.5	2.004	0.607
2.6	2.312	0.708
2.7	2.598	0.804
2.8	2.863	0.894
2.9	3.109	0.980
3.0	3.340	1.062
3.1	3.555	1.140
3.2	3.757	1.214
3.3	3.947	1.284
3.4	4.126	1.352
3.5	4.294	1.416
3.6	4.453	1.478
3.7	4.604	1.537
3.8	4.746	1.593
3.9	4.881	1.647
4.0	5.010	1.699
4.1	5.132	1.749
4.2	5.248	1.797
4.3	5.359	1.844
4.4	5.465	1.888
4.5	5.566	1.931
4.6	5.663	1.972
4.7	5.756	2.012
4.8	5.845	2.051
4.9	5.930	2.088
5.0	6.012	2.124
5.1	6.090	2.159
5.2	6.166	2.193
5.3	6.239	2.225
5.4	6.309	2.257
5.5	6.376	2.288
5.6	6.441	2.317
5.7	6.504	2.346
5.8	6.564	2.374
5.9	6.623	2.401
6.0	6.680	2.428
6.1	6.734	2.453
6.2	6.787	2.478
6.3	6.839	2.502
6.4	6.888	2.526
6.5	6.937	2.549
6.6	6.983	2.571
6.7	7.029	2.593
6.8	7.073	2.614
6.9	7.115	2.635
7.0	7.157	2.655
7.1	7.197	2.675
7.2	7.236	2.694
7.3	7.274	2.713
7.4	7.312	2.731
7.5	7.348	2.749
7.6	7.383	2.766
7.7	7.417	2.783
7.8	7.450	2.800
7.9	7.483	2.816
8.0	7.515	2.832
9.0	7.793	2.974
10.0	8.016	3.090
11.0	8.198	3.186
12.0	8.350	3.268
13.00	8.478	3.338
14.00	8.588	3.399
15.00	8.683	3.452
16.00	8.767	3.499

NOTE—
Only 3-U, 3-Z machines will operate between reductions 1 and 2.

For reductions from 1 to 2, see drawing 7561 in back of book.

FORM 989-A
SCHEDULE OF REDUCTIONS FOR ENGRAVING MACHINES NOS.
1D, 1J.
3D, 3J, 3U, 3Z.

REDUCTION	LOWER BAR MILLIMETERS	UPPER BAR MILLIMETERS
2.0	00.00	0.00
2.1	12.12	3.48
2.2	23.14	6.74
2.3	33.19	9.81
2.4	42.42	12.69
2.5	50.90	15.41
2.6	58.73	17.98
2.7	65.98	20.41
2.8	72.71	22.72
2.9	78.98	24.90
3.0	84.83	26.98
3.1	90.30	28.95
3.2	95.44	30.83
3.3	100.26	32.62
3.4	104.79	34.33
3.5	109.07	35.97
3.6	113.11	37.53
3.7	116.93	39.03
3.8	120.55	40.46
3.9	123.98	41.84
4.0	127.25	43.16
4.1	130.35	44.43
4.2	133.31	45.65
4.3	136.13	46.83
4.4	138.82	47.96
4.5	141.39	49.05
4.6	143.84	50.10
4.7	146.20	51.11
4.8	148.46	52.09
4.9	150.62	53.04
5.0	152.70	53.95
5.1	154.69	54.84
5.2	156.61	55.69
5.3	158.46	56.52
5.4	160.24	57.33
5.5	161.95	58.10
5.6	163.60	58.86
5.7	165.20	59.59
5.8	166.74	60.30
5.9	168.23	60.99
6.0	169.66	61.66
6.1	171.05	62.31
6.2	172.40	62.95
6.3	173.70	63.56
6.4	174.97	64.16
6.5	176.19	64.74
6.6	177.38	65.31
6.7	178.53	65.87
6.8	179.64	66.40
6.9	180.73	66.93
7.0	181.78	67.44
7.1	182.81	67.94
7.2	183.80	68.43
7.3	184.77	68.90
7.4	185.71	69.37
7.5	186.63	69.82
7.6	187.52	70.26
7.7	188.39	70.70
7.8	189.24	71.12
7.9	190.07	71.53
8.0	190.87	71.94
9.0	197.94	75.53
10.0	203.60	78.48
11.0	208.22	80.93
12.0	212.08	83.01
13.0	215.34	84.78
14.0	218.13	86.32
15.0	220.56	87.67
16.0	222.68	88.86

REDUCTION FORMULA and SCHEDULES in INCHES
for 3-B, 3-L MACHINES

REG U S PAT OFF TRADE MARK GORTON RACINE, WIS., U.S.A.

FORM 1461
SCHEDULE OF REDUCTIONS FOR No. 3-B ENGRAVING MACHINE.

REDUCTIONS	DISTANCE IN INCHES TO SET ALL SLIDER BLOCKS FROM GRADUATION 2.
2.0	0.000
2.1	0.381
2.2	0.727
2.3	1.043
2.4	1.333
2.5	1.600
2.6	1.846
2.7	2.074
2.8	2.286
2.9	2.483
3.0	2.667
3.1	2.839
3.2	3.000
3.3	3.152
3.4	3.294
3.5	3.429
3.6	3.556
3.7	3.676
3.8	3.789
3.9	3.897
4.0	4.000
4.1	4.098
4.2	4.190
4.3	4.279
4.4	4.364
4.5	4.444
4.6	4.522
4.7	4.596
4.8	4.667
4.9	4.735
5.0	4.800
5.1	4.863
5.2	4.923
5.3	4.981
5.4	5.037
5.5	5.091
5.6	5.143
5.7	5.193
5.8	5.241
5.9	5.288
6.0	5.333
6.1	5.377
6.2	5.419
6.3	5.460
6.4	5.500
6.5	5.538
6.6	5.576
6.7	5.612
6.8	5.647
6.9	5.681
7.0	5.714
7.1	5.746
7.2	5.778
7.3	5.808
7.4	5.838
7.5	5.867
7.6	5.895
7.7	5.922
7.8	5.949
7.9	5.975
8.0	6.000

FORM 1463
FORMULA FOR OBTAINING SPECIAL REDUCTIONS ON No. 3-B ENGRAVING MACHINE.

EXAMPLE

REDUCTION REQUIRED 2.4

CONSTANT → 16 / REDUCTION → 2.4 = 6.667

CONSTANT → 8.000 − 6.667 = 1.333"

DISTANCE IN INCHES TO SET ALL FOUR SLIDER BLOCKS FROM GRADUATION 2 FOR 2.4 REDUCTION.

For 3-B, 3-L Area chart. See folded flap at back of book.

FORM 1464
FORMULA FOR OBTAINING SPECIAL REDUCTIONS ON No. 3-L ENGRAVING MACHINE.

EXAMPLE

REDUCTION REQUIRED 2.4

CONSTANT 24 / REDUCTION 2.4 = 10.000

CONSTANT → 12.000 − 10.000 = 2.000"

DISTANCE IN INCHES TO SET ALL FOUR SLIDER BLOCKS FROM GRADUATION 2 FOR 2.4 REDUCTION.

FORM 1462
SCHEDULE OF REDUCTIONS FOR No. 3-L ENGRAVING MACHINE.

REDUCTIONS	DISTANCE IN INCHES TO SET ALL SLIDER BLOCKS FROM GRADUATION 2.
2.0	0.000
2.1	0.571
2.2	1.091
2.3	1.565
2.4	2.000
2.5	2.400
2.6	2.769
2.7	3.111
2.8	3.429
2.9	3.724
3.0	4.000
3.1	4.258
3.2	4.500
3.3	4.727
3.4	4.941
3.5	5.143
3.6	5.333
3.7	5.514
3.8	5.684
3.9	5.846
4.0	6.000
4.1	6.146
4.2	6.286
4.3	6.419
4.4	6.545
4.5	6.667
4.6	6.783
4.7	6.894
4.8	7.000
4.9	7.102
5.0	7.200
5.1	7.294
5.2	7.385
5.3	7.472
5.4	7.556
5.5	7.636
5.6	7.714
5.7	7.789
5.8	7.862
5.9	7.932
6.0	8.000
6.1	8.066
6.2	8.129
6.3	8.190
6.4	8.250
6.5	8.308
6.6	8.364
6.7	8.418
6.8	8.471
6.9	8.522
7.0	8.571
7.1	8.620
7.2	8.667
7.3	8.712
7.4	8.757
7.5	8.800
7.6	8.842
7.7	8.883
7.8	8.923
7.9	8.962
8.0	9.000

P13 THREE-DIMENSIONAL *RATIOBAR PANTOGRAPH MACHINE

UNPACKING

Examine the case in which the machine is received to see that it is intact and has not been damaged in transit. After removal from the case, check all parts with packing list. Carefully examine all packing paper and excelsior to make sure that no small parts are overlooked. The motor, motor support, and motor counterweight are bolted to the skid for shipping purposes.

IMPORTANT: *Do not remove wooden shipping clamp from Ratiobar until machine has been moved to its final place of operation.*

CLEANING

Flushing oil is preferable for use in cleaning the machine. Using rags free from lint, and fresh flushing oil, wipe the entire machine thoroughly. Be especially careful not to soak the felt seals provided at each pantograph bearing. Use extreme care in cleaning around the Ratiobar, making certain no foreign matter is brushed into the ball races, and DO NOT flood these races with oil. DO NOT use compressed air at any time.

LOCATING THE MACHINE

All machines are shipped completely assembled with the exception of the copyholder and drive motor assembly. The motor should be assembled to the machine before it is moved to the final place of operation. Locate the machine base in its desired position, centered in front of a good window light, with operator's left side to the window. Daylight is preferable when conditions permit, although good, indirect, artificial lighting affords satisfactory operating conditions. Machine lamps are available to insure maximum visibility.

LEVELING

A solid, level floor is of primary importance. Place a machinist level on the machine table and shim up base to proper level as required. The four drilled holes in the base which were used for shipping bolts can be used to anchor the machine to the floor for added stability. Should the floor transmit too much vibration from surrounding machinery, it is recommended that the machine be set on rubber shock mounts.

PUTTING INTO SERVICE

After the machine has been properly located, leveled and wired, remove the wooden shipping clamp. Next, the drive belts are placed in position. Belt tension adjustments are made with the motor counterweight and the belt tension rod, increasing tension only to that point which eliminates whipping of belt at high speeds. Excessive tension causes stretch, rapid wear, and places undue strain on the spindle bearings. The belt guard, which is tied to the column for shipping, should now be untied and swung into position. The copyholder is mounted in place on the support adjacent to the machine table proper. DO NOT ADJUST the 2 hexagon head stop screws on the copyholder support as they have been accurately set at the factory. The copyholder must be placed firmly against one or the other of these stop screws when clamping in place to provide accurate alignment with the machine table.

SETTING THE PANTOGRAPH

The copy is laid out to keep within the range limits of the pantograph. The setting of the pantograph is then determined from the size of the work to be engraved or milled.

EXAMPLE:

If length of copy is 10" and length of job desired is 2", divide the length of the copy or model by the length of the job: 10" ÷ 2" = 5. Therefore, set the front pantograph block at reduction 5. If length of copy is 11" and length of job is 4", then the reduction is 11" ÷ 4" = 2.75. You will note that reduction 2.75 is not marked on the pantograph bar. For intermediate reductions not marked on the pantograph bar, use the following formula:

$$(9 \text{ constant} - \frac{18 \text{ constant}}{\text{Reduction}}) = \begin{cases} 2 \text{ to desired reduction} \\ \text{Distance from graduation} \end{cases}$$

Example:

Desired reduction is 10:1

$$9 - \frac{18}{10} = 9 - 1.8 = 7.2$$

Measure 7.200" from graduation 2 to set Pantograph for 10:1 reduction.

ALL SETTINGS ARE MEASURED FROM THE 2:1 GRADUATION MARK ON THE PANTOGRAPH BAR.

To set the pantograph, use the special wrench provided with the machine and loosen the 2 cap screws on each slider block. Carefully align front slider block index line (on finger extending from right-hand side of block) with graduation line of desired reduction on pantograph bar. Check setting and tighten screws on both blocks using just enough force to insure a positive lock. Take care that the edges of blocks or bar are not dented or nicked. These parts are carefully fitted, no force being necessary to slip the bar in the blocks. Never force them by striking with a hammer or any similar object. If, at any time while setting the pantograph, you find these blocks too tight, ascertain the cause. It may be the screws haven't been loosened sufficiently, or the slides have become gummed with oil.

TRACING STYLUS, CUTTERS, COPYHOLDERS AND MASTERS

For selection and use, see Index.

*Patents Applied For.

P13 THREE-DIMENSIONAL *RATIOBAR PANTOGRAPH MACHINE

CUTTER SPINDLE

Spindle bearings are not manually adjustable, but automatically take up normal wear. Proper lubrication will prevent excessive wear and increase operating efficiency. The spindle is quickly removable; and, should repair or replacement be necessary, we suggest the spindle be returned to factory for overhaul, which will be done promptly at a nominal cost. This will make the spindle as accurate as new.

To remove cutter spindle, first remove belt; next, push feed lever, which extends toward operator from top of spindle, to the left as far as it will go; then, disengage lock pin located in center of cutter head casting (acorn nut) by pulling out and turning one quarter turn. Grasp spindle pulley with one hand and push hinged bolt to right; then swing hinged cap to left and lift spindle free.

The P13 cutter spindle is, with minor variations, identical to the 3-U cutter spindle. See Index for assembly and parts drawings; also Pantograph Bulletin, 1580.

IMPORTANT — When ordering Repair Parts, give serial number of machine found on pad on front of Ratiobar casting.

TABLE, SADDLE AND KNEE

Construction and operation of the P13 table, saddle and knee are identical with the 3-U with the exception of the copyholder bracket. Each unit is provided with a gib and adjusting screws. To tighten gibs, turn adjusting screws, applying equal pressure at all points. When properly adjusted, all play will be eliminated; feed screws should have a smooth, free feel. If feed screw operation is stiff or jerky too much pressure has been applied to gib. The table and saddle feed screws are each provided with thrust bearing adjustments to eliminate any play that may develop after a number of years' operation. Table, saddle and knee feed screws are each provided with micrometer dials graduated to thousandths of an inch. They are of the slip-type for setting to zero for quick, accurate adjustments. IMPORTANT: After machine has been set up for operation, but before taking a cut, make sure the table, saddle, knee and copyholder have been locked. The table lock screw has a knurled head and is located on the right-hand side of table. The lever extending from the bottom of the saddle casting is on the saddle lock screw. On the right-hand side of the knee is the knee lock screw. The copyholder has a clamp lever located on the support bracket just below the copyholder.

SETTING THE CUTTER AND STYLUS FOR THREE-DIMENSIONAL WORK

Each machine is equipped with a special 3-dimensional Cutter-Stylus Alignment Gage, and bears the serial number of the machine with which it must be used. These gages are not interchangeable between different machines. Each Cutter-Stylus Gage has been accurately set for each machine and adjustments sealed. DO NOT change the adjustments. The Cutter-Stylus Gage is used to align the cutter point and the stylus point with the Ratiobar pivot center.

To set the cutter to the proper position, first insert the cutter without tightening the collet nut. Next, mount the Cutter-Stylus Gage on the 2 locating pins provided on the cutter head casting. Lower the cutter by moving the spindle feed lever to the extreme left. With the thumb and forefinger draw down the cutter until it contacts the Cutter-Stylus Gage. Then tighten the cutter in the spindle. A final check is made to assure proper setting. If the cutter has shifted slightly, it can be returned to the proper setting by means of the knurled adjustment located at the top of the spindle. After this adjustment has been made, lock with jam nut, located immediately below it. It may be helpful to insert a thin sheet of paper between the cutter point and the Cutter-Stylus Gage button to prevent damaging the cutter during this set-up. Now, move spindle feed lever to extreme right and remove gage.

A similar procedure is followed in setting the tracing stylus with the exception that the tracing spindle has a built-in spring which moves the stylus downward automatically when the clamp is released. On completion of the set-up, clamp the tracing spindle, remove the Cutter-Stylus Gage, and the machine is ready for operation.

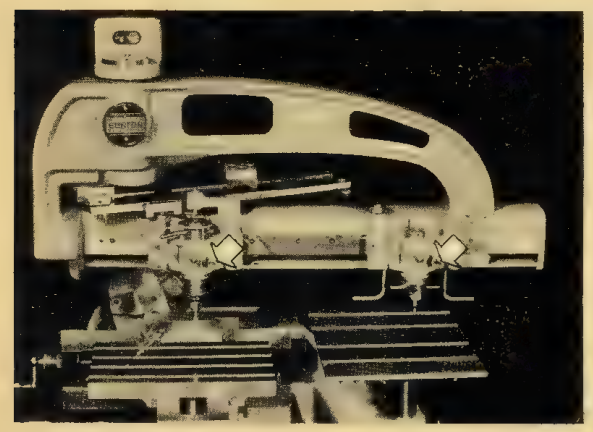
After the cutter and stylus have been set, the next step is to adjust the counterbalance spring tension. This adjustment varies for different pantograph ratio settings. First, release the pivot center lock by loosening the *large*, knurled clamp located at pivot center. This clamp is located directly above the square tool shelf. Swing down and away from the upper casting, and at the same time, swing down the 2-dimensional stop plate. This readies the machine for 3-dimensional operation. The smaller, knurled knob located at the pivot center is the counterbalance spring adjustment. It should be set so a slight downward pressure is required to keep the tracing stylus in contact with the model or master.

The main counterbalance spring on the left-hand side of the machine has been adjusted at the factory but may require additional adjustment from time to time.

ENLARGING

On the P13 it is also possible to enlarge work. Working from a small master or model, it will produce work several times larger than the model. The minimum enlargement ratio is 2:1, and while the

P13 THREE-DIMENSIONAL *RATIOBAR PANTOGRAPH MACHINE

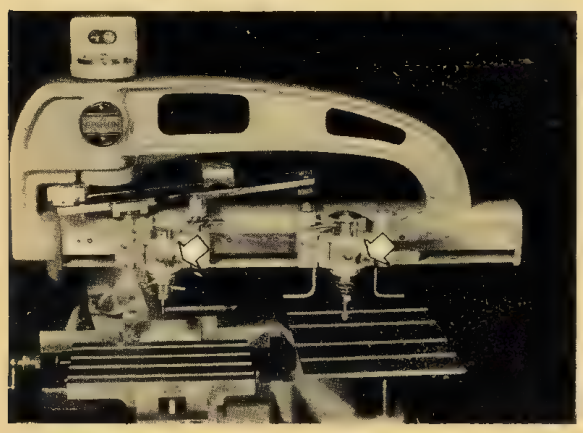


P13 Pantograph with spindles in normal positions for work at reduction ratios.

machine is capable of enlarging at ratios similar to those used for reducing, it is not practical to use ratios much greater than 3:1. As the enlarging ratio is increased, operation of the pantograph becomes more difficult because of the reverse leverage.

For enlarging work, it is necessary only to transpose the cutter spindle with the tracer spindle. Disengage lock pin (acorn nut) in center of cutter and tracer head castings by pulling out and turning right or left one-quarter turn. Pull out and swing to right the two knurled knobs indicated by arrows.

Remove belt; lower cutter spindle by turning spindle feed lever to left until it hits stop. Now swing hinged caps of both spindles to left. This releases both spindle assemblies. Transpose spindles, swing hinged caps back in place, lock with the two knurled knobs and then reset acorn nuts and attach belt and belt tension rod.



P13 Pantograph with spindles transposed for enlarging work.

USE OF FORMING GUIDE — from 2 to 1 to approximately 7 to 1

Work of uniform curvature can also be engraved and milled on the Gorton P13 3-Dimensional Pantograph Machine without the necessity of a 3-dimensional model. The machine may be operated either 2 or 3-dimensionally on forming guide work. For this type of work a hardened steel forming guide is used with flat copy or master template.

The forming guide should be the *exact opposite* of the work and preferably made of hardened tool steel. For instance, if the work is convex, the forming guide should be concave. Before using, its contour should be matched precisely with the part to be engraved or milled. This is done with the use of lamp black, mechanics' blue, etc.

The L-shaped forming guide bracket is shipped mounted on the machine in a reverse position. It must be removed and remounted so the leg extends out over the spindle or toward the front of the machine. The guide itself is then fastened to this bracket with the 4 cap screws supplied.

Assuming that the work is secured to the work table and the master or template is on the copyholder, the general procedure is as follows:

(a) Check to see that cutter point and former point (extending up from top of Spindle Feed Bracket Casting) are approximately the same size, especially on work having a small radius.

(b) Lock spindle floating movement with plunger located on front of spindle housing, and locate work in relation to master template.

(c) Release spindle floating movement by pulling out plunger and turning a quarter-turn. Next, release set screw which locks vertical motion of the former point. This set screw is located on the upper front of the spindle feed bracket. The former point should now be in contact with the forming guide.

(d) Extreme care should be exercised in locating the forming guide in exact relation to the work.

(e) Insert the proper tracing style and cutter.

CAUTION: When using a flat master, BE SURE the two-dimensional stop plate is swung into position against the stop pin, and is securely clamped with the large, knurled knob.

The making of forming guides can be avoided in many cases through the use of adjustable forming guides, described in our Small Tools and Accessories Catalog. They save the expense of making hardened guides from solid steel blocks.

Forming guides may be made by turning on a lathe, shaping on a planer, milling with a form cutter, or by hand with a file or hand grinder. For additional information on forming guide work, refer to pages 27 and 28 of this instruction book.

P13 THREE-DIMENSIONAL *RATIOBAR PANTOGRAPH MACHINE

LUBRICATION

Correct Oils and Greases provide Efficient Performance.

Thorough research and tests have proven oils and greases recommended herein give maximum operating efficiency to this machine. Only high quality oils and greases should be used.

HIGH SPEED SPINDLE

For lubricating the high speed spindle, use a pure mineral oil, such as Gargoyle Velocite Oil S or equivalent, with viscosity rating of approximately 80 seconds S. U., at 100° F. Avoid using gum-forming household types of oils, which may cause bearing failure from gum deposits within the bearings. Oil twice a day through the openings at top of spindle.

OIL HOLES AND OIL CUPS

For all other oil holes and oil cups, use a medium machine oil, such as Gargoyle Vactra Oil Heavy Medium X. Oil cups on idler pulleys should be filled twice each day.

GREASE CUPS AND PANTOGRAPH BEARINGS

Use a high grade ball bearing grease of medium consistency equivalent to Gargoyle Grease BRB No. 2. Be sure grease cup is wiped clean before removing to refill. Grease cup on intermediate drive pulley should be given one turn each week. Pantograph bearings should be filled once a year

RATIOBAR BALL TRACKS

Wipe off ball tracks once a week with clean cloth free from lint. Remove all foreign particles. Apply a few drops of oil to a clean cloth and carefully wipe over the ball tracks to prevent rusting. Note: The ball tracks are provided with graphite wipers which both wipe and lubricate the ways. Do not under any circumstances apply more than just a light film of oil as outlined; otherwise the graphite wipers become soft, gathering chips and foreign matter.

TABLE, SADDLE AND KNEE WAYS AND SCREWS

The scraped machined ways and feed screws should be lubricated daily with a good grade of light machine oil. Move the table and knee to the extremes of adjustment and coat ways with a thin film of oil, at the same time applying oil along the exposed portions of the feed screws. Move to opposite extremes and repeat. Apply a few drops of oil in a similar manner to the copyholder adjusting screw and the two pilot sleeves.

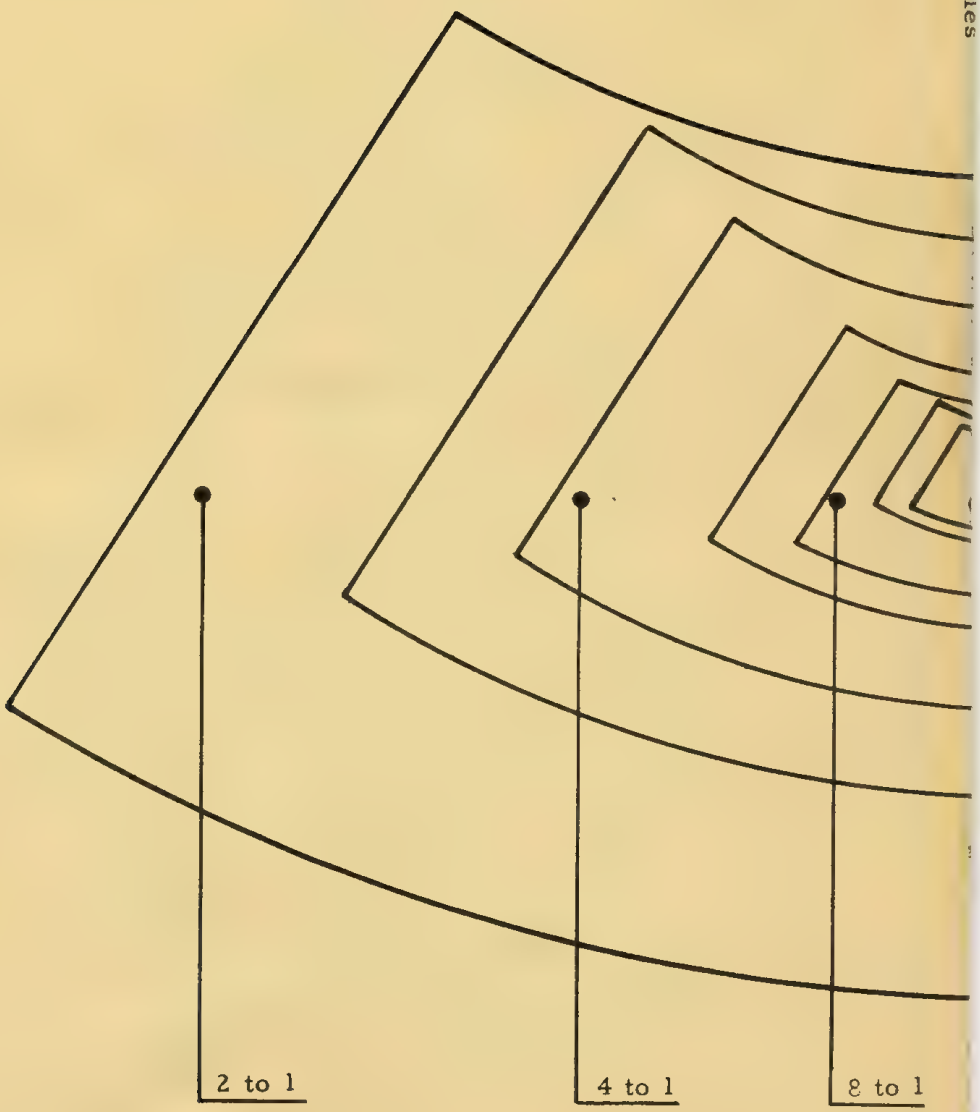
ELECTRIC MOTOR

The motor supplied with this machine has sleeve-type bearings which require a medium-bodied bearing lubricant such as Gargoyle Etna Oil Heavy Medium. A few drops every 1000 hours is sufficient.

(See Area Chart on Pages 58 and 59)

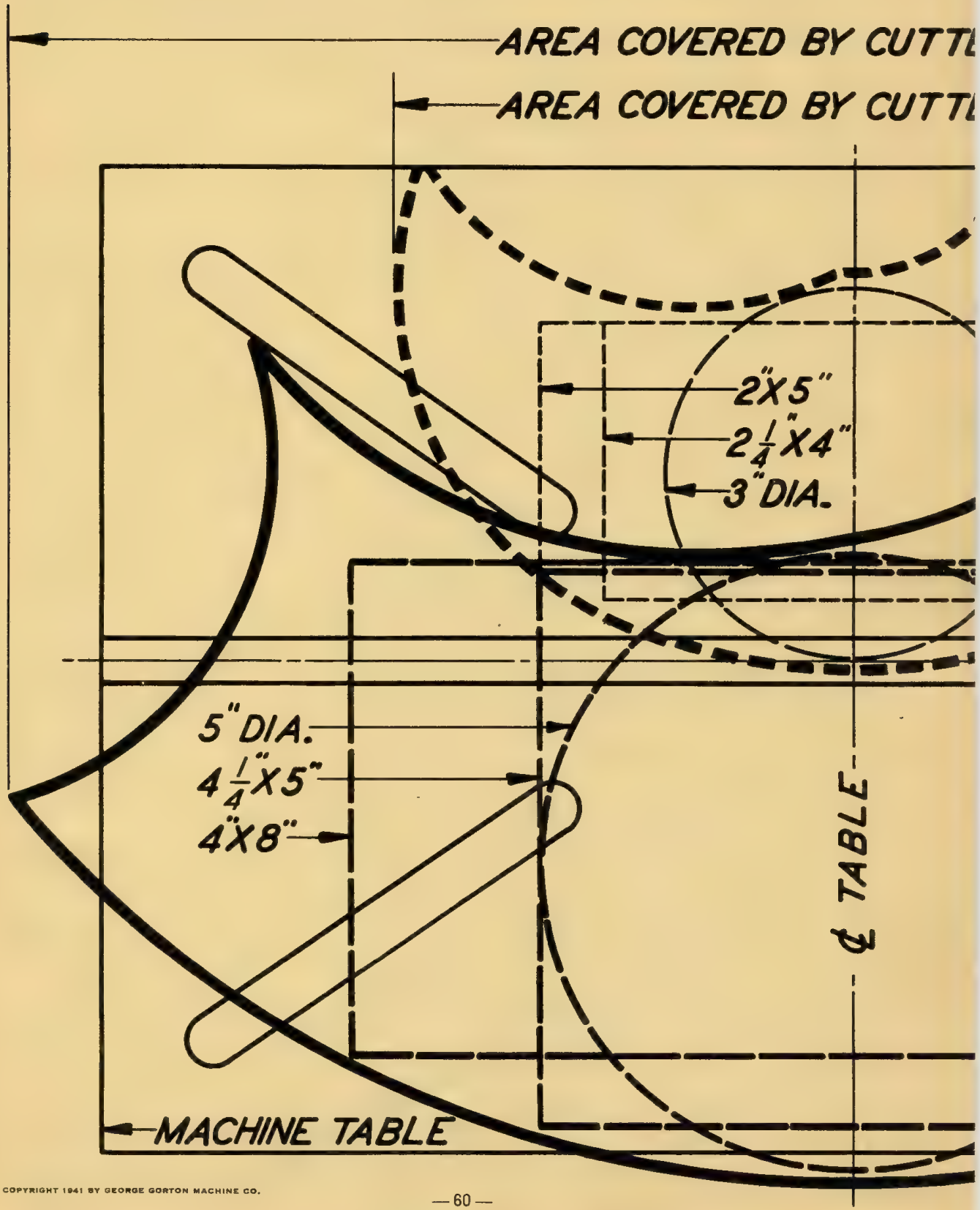
P1-3 ARE

ACTUAL AREAS CO
POINT AT REDUCTI
BEGINNING WITH MAC



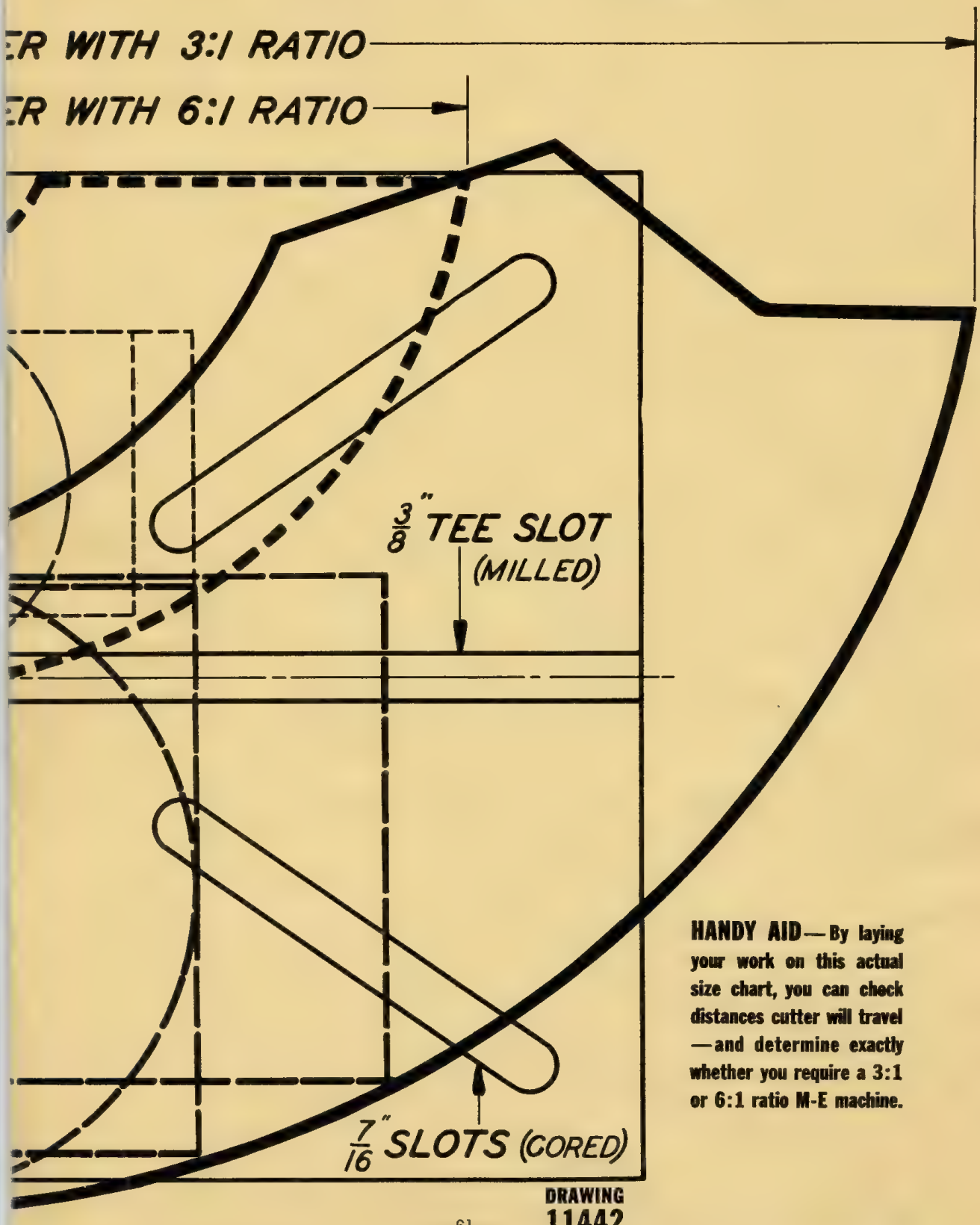
A CHART

VERED BY CUTTER
ONS SHOWN BELOW
HINE SERIAL NO. 32700



ENGRAVER AREA-CHART

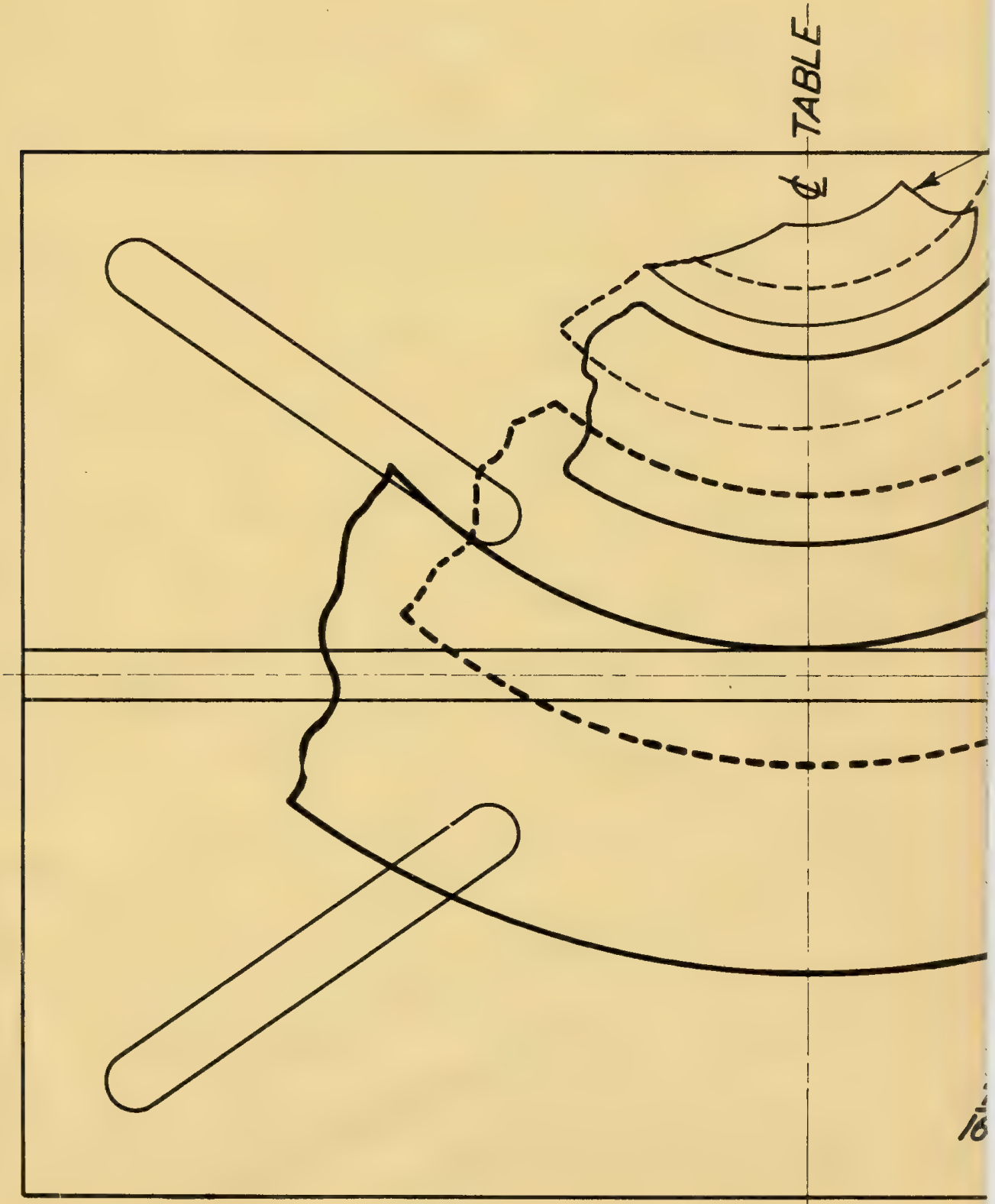
(ACTUAL SIZE)



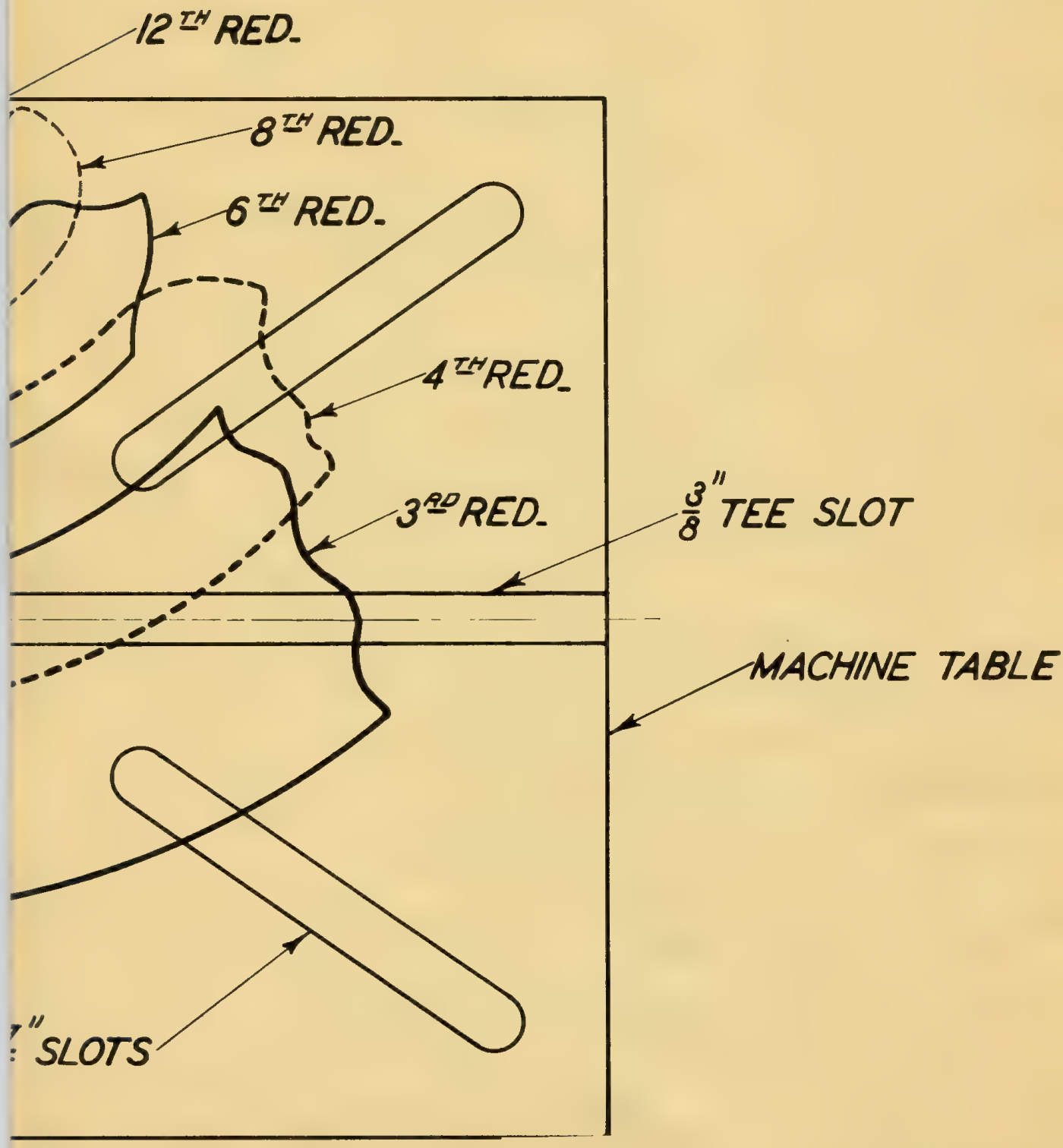
HANDY AID—By laying your work on this actual size chart, you can check distances cutter will travel—and determine exactly whether you require a 3:1 or 6:1 ratio M-E machine.

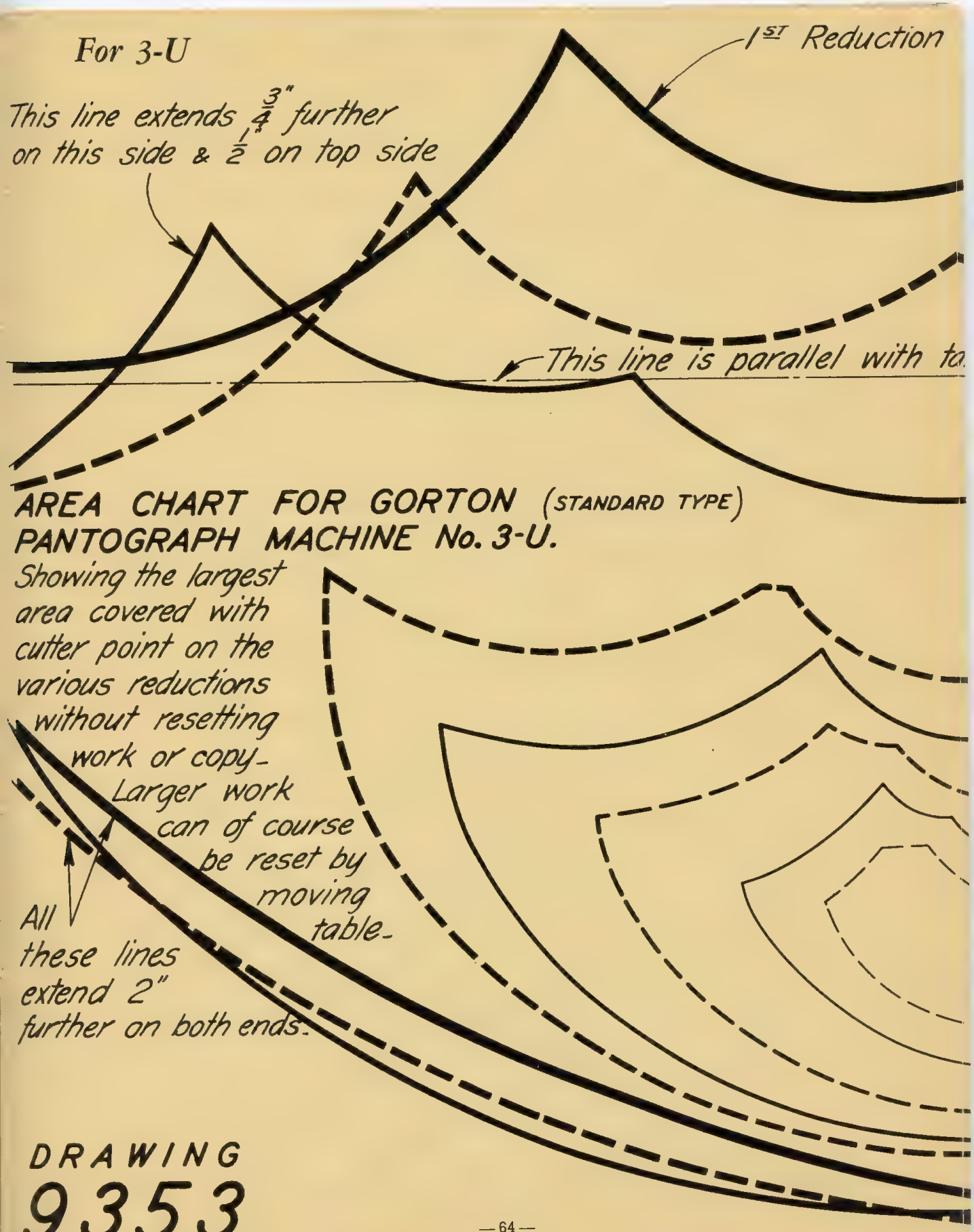
DRAWING
11442

M-E (MUNITIONS ENGRAVER) ADJU



STABLE PANTOGRAPH AREA CHART





AREA CHART FOR GORTON (STANDARD TYPE) PANTOGRAPH MACHINE No. 3-U.

Showing the largest area covered with cutter point on the various reductions without resetting work or copy- Larger work can of course be reset by moving table-

All these lines extend 2" further on both ends.

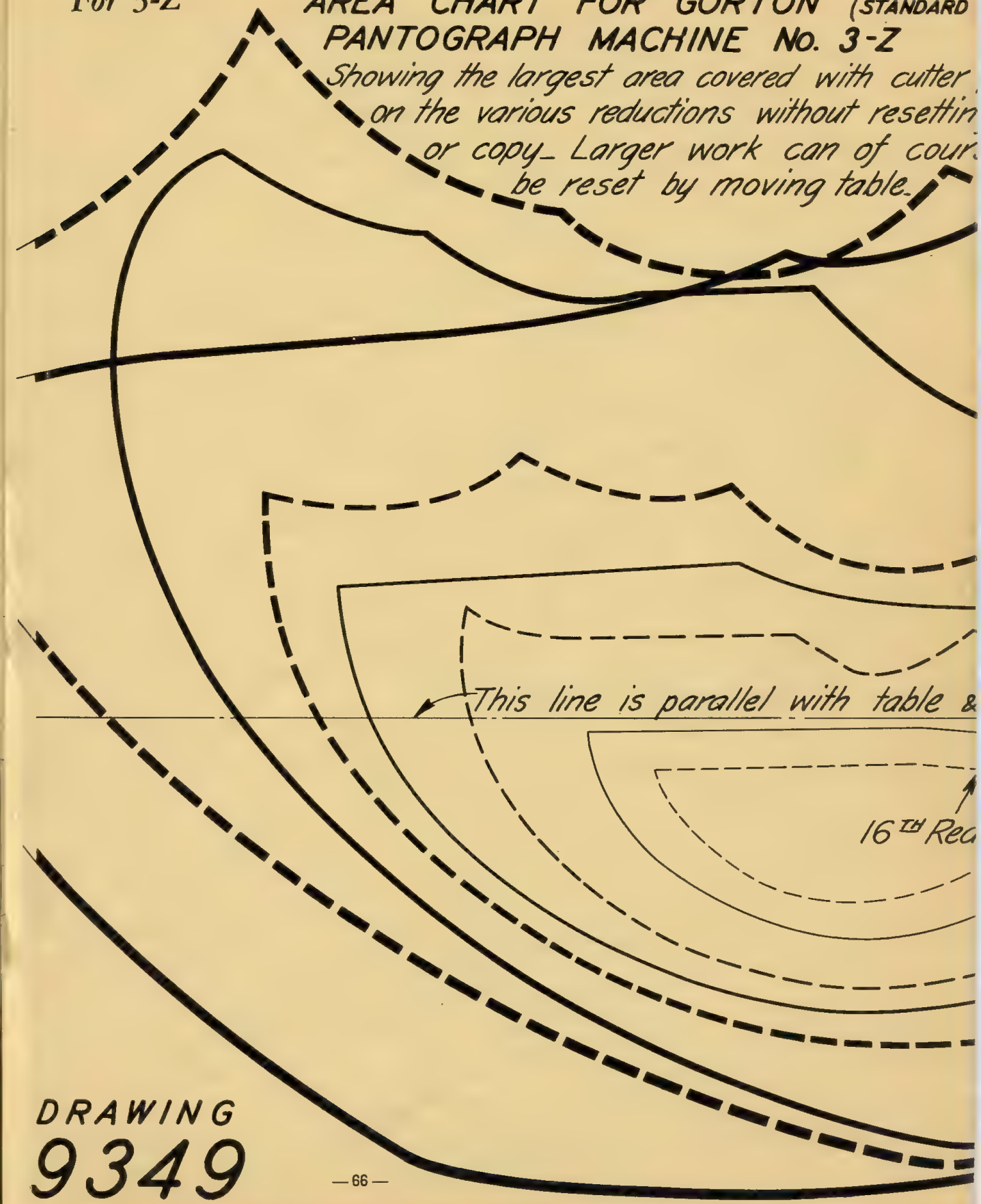
DRAWING
9353


2ND Red.
3RD Red.
1ST Red.
ble & copyholder.
6TH Red.
8TH Red.
5TH Red.
12TH Red.
16TH Red.

For 3-Z

AREA CHART FOR GORTON (STANDARD PANTOGRAPH MACHINE No. 3-Z

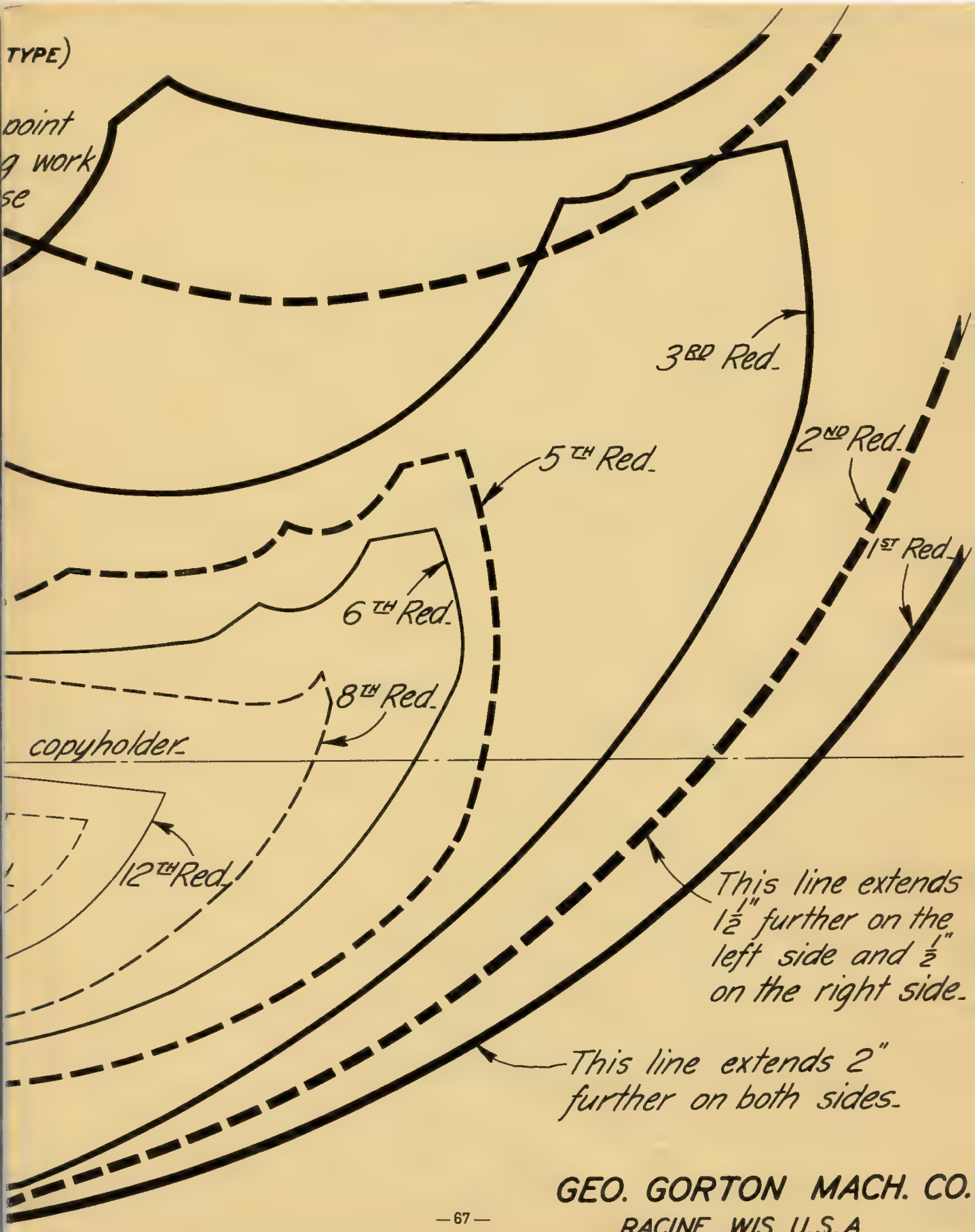
Showing the largest area covered with cutter on the various reductions without resettin or copy_ Larger work can of cour be reset by moving table_



DRAWING
9349

TYPE)

point
g work
se



GEO. GORTON MACH. CO.
RACINE, WIS., U.S.A.

For 3-S

AREA CHART FOR 3-S DIE CUTTING AND PROFILING MACHINE – (STANDARD TYPE)

Showing the largest area covered with cutter point on the various reductions without resetting work or copy. Work can of course be set by moving table.

FORMULA

For obtaining any intermediate reduction not given on pantograph scales.

EXAMPLE 3.5 (Reduction required)

CONSTANT 3.5

$$+1.0$$

$$4.5$$

CONSTANT

$$\frac{24.}{4.5} = 5.333$$

CONSTANT 5.333

$$-3.000$$

$$2.333 \text{ Inches}$$

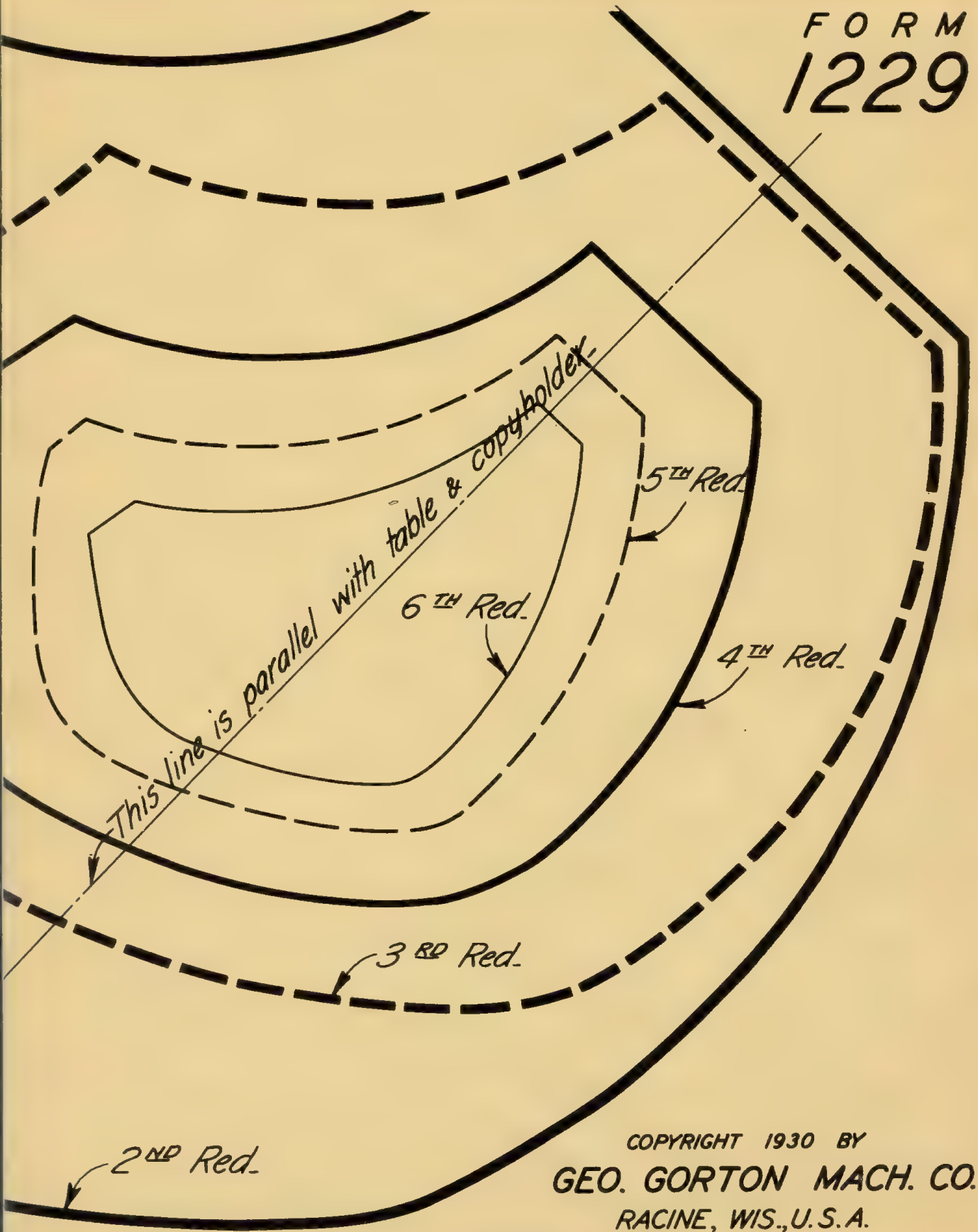
Set all three Pantograph scales to this reading for 3.5 reduction.

NOTE

The one to one pantograph setting is too large to show hereon. Blue-print 6499 of same will be sent on request. On the one to one setting, the following areas can be covered at one setting of work & copy:

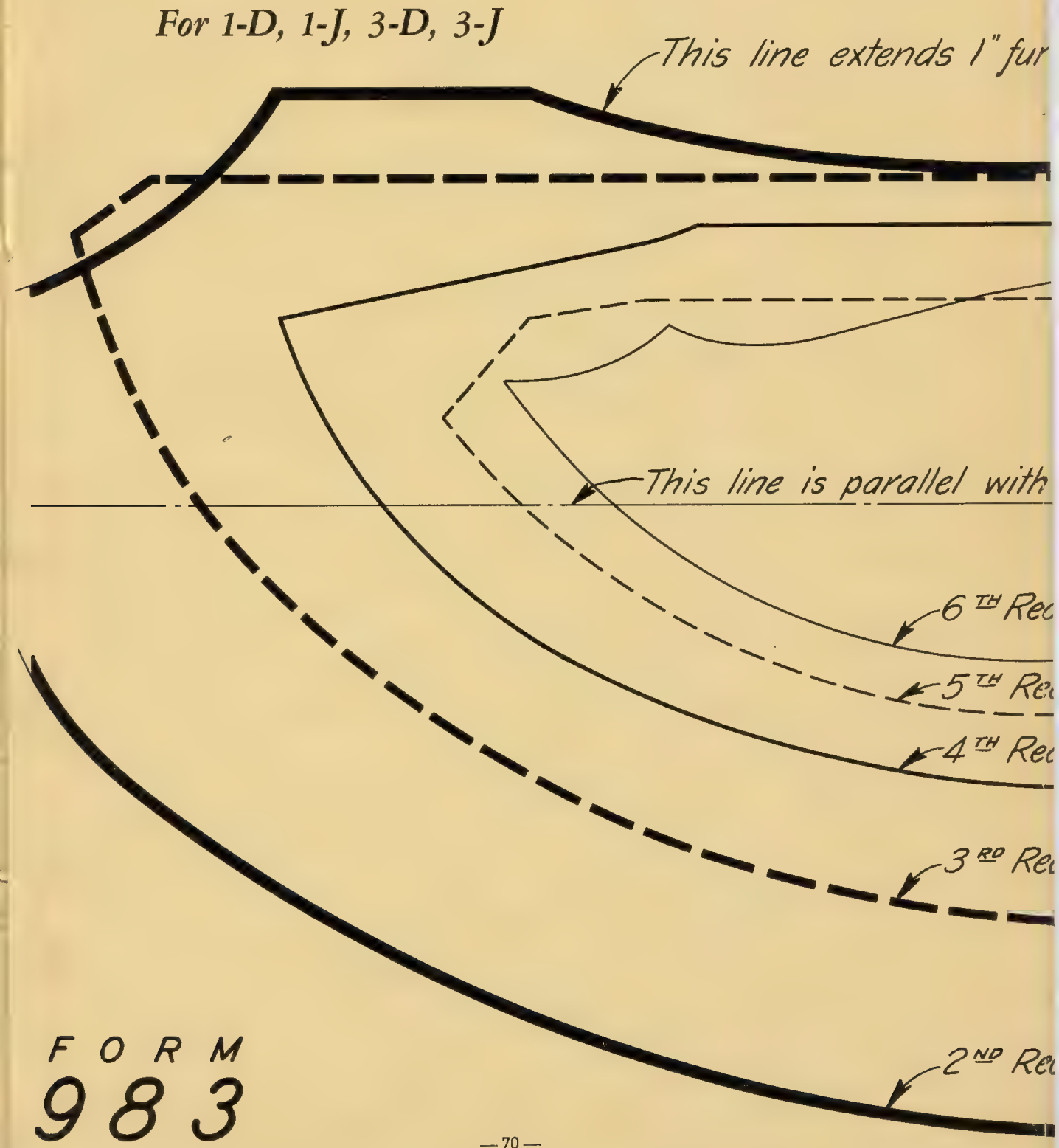
$14'' \times 9\frac{3}{4}''$ \ $18'' \times 8\frac{3}{8}''$ \ $21'' \times 4''$ \ $23'' \times 2\frac{1}{2}''$

FORM
1229



AREA CHART FOR GORTON PANTOGRAPH MACHIN

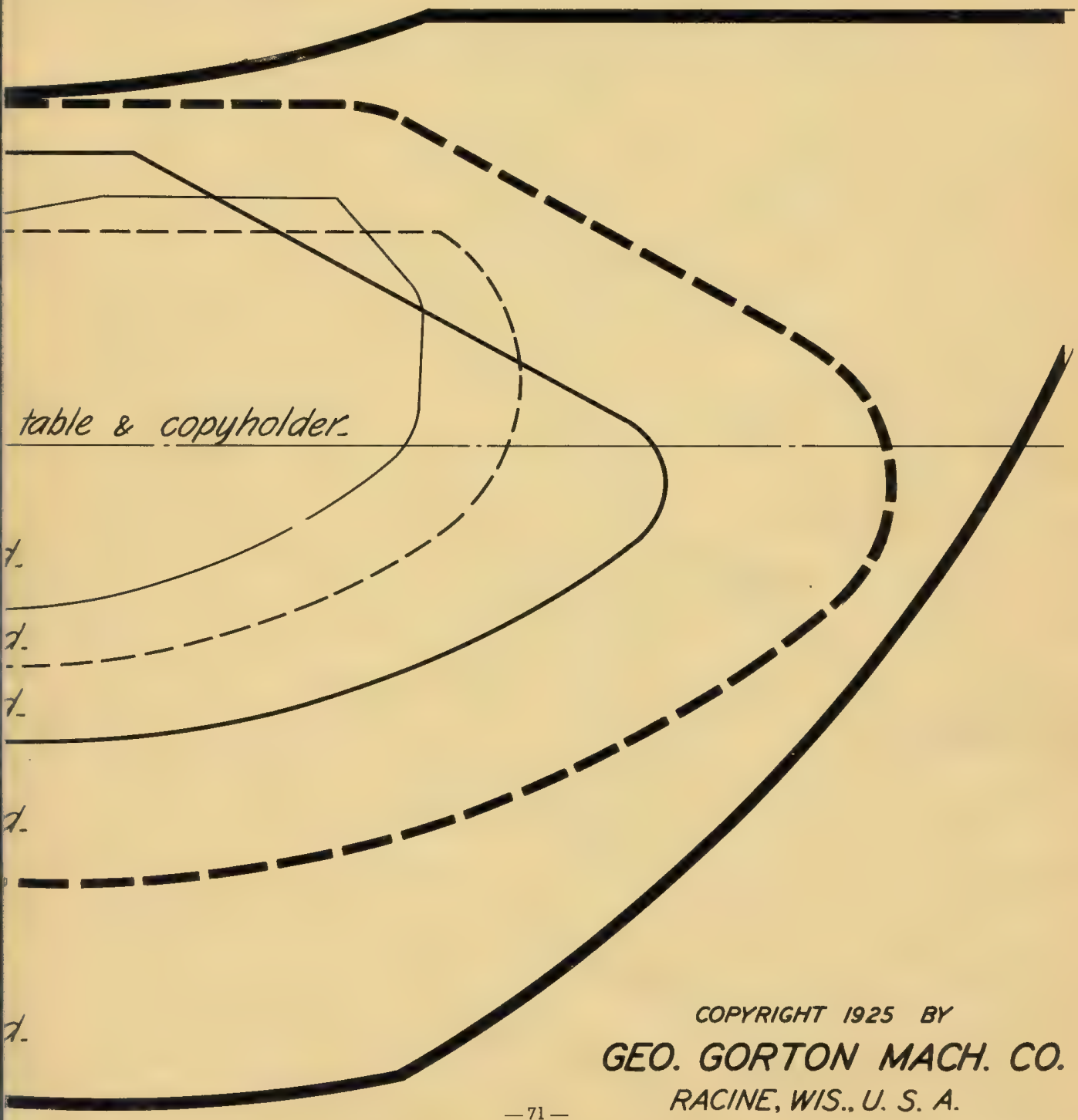
Showing the largest area covered with cutter point on the va.
Larger work can of course be reset by moving table.



FORM
983

IES, (STANDARD TYPE) NO'S. 1-D, 1-J, 3-D, 3-J. (NOW OBSOLETE)
rious reductions without resetting work or copy.

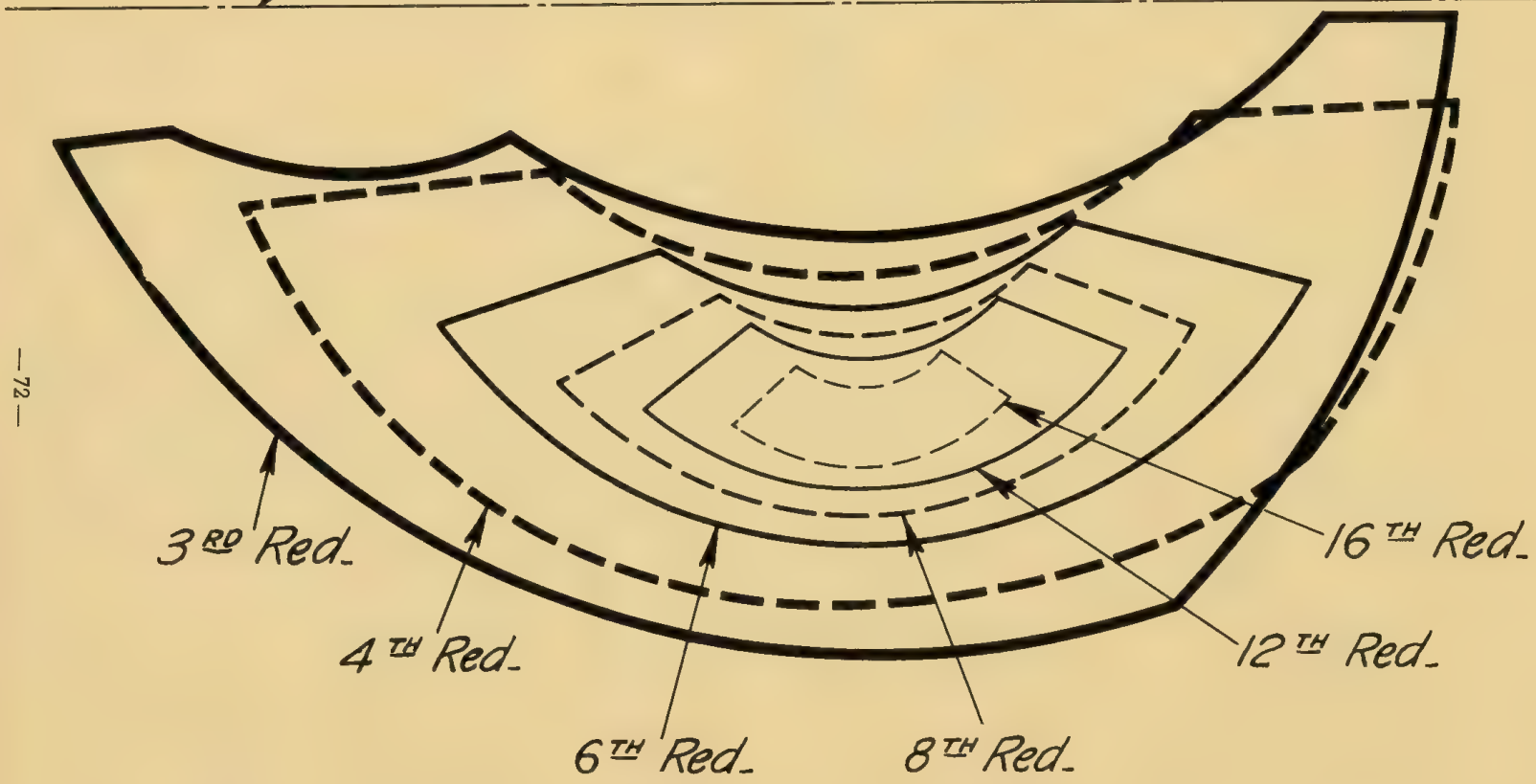
ther on both sides.



AREA CHART FOR GORTON PANTOGRAPH MACHINES.

(STANDARD TYPE) NO'S. 1-A, 1-G, 1-H, 3-A, 3-G, 3-H. (NOW OBSOLETE)

Showing the largest area covered with cutter point on the various reductions without resetting work or copy. Larger work can of course be reset by moving table.



For 1-A, 1-G, 1-H, 3-A, 3-G, 3-H

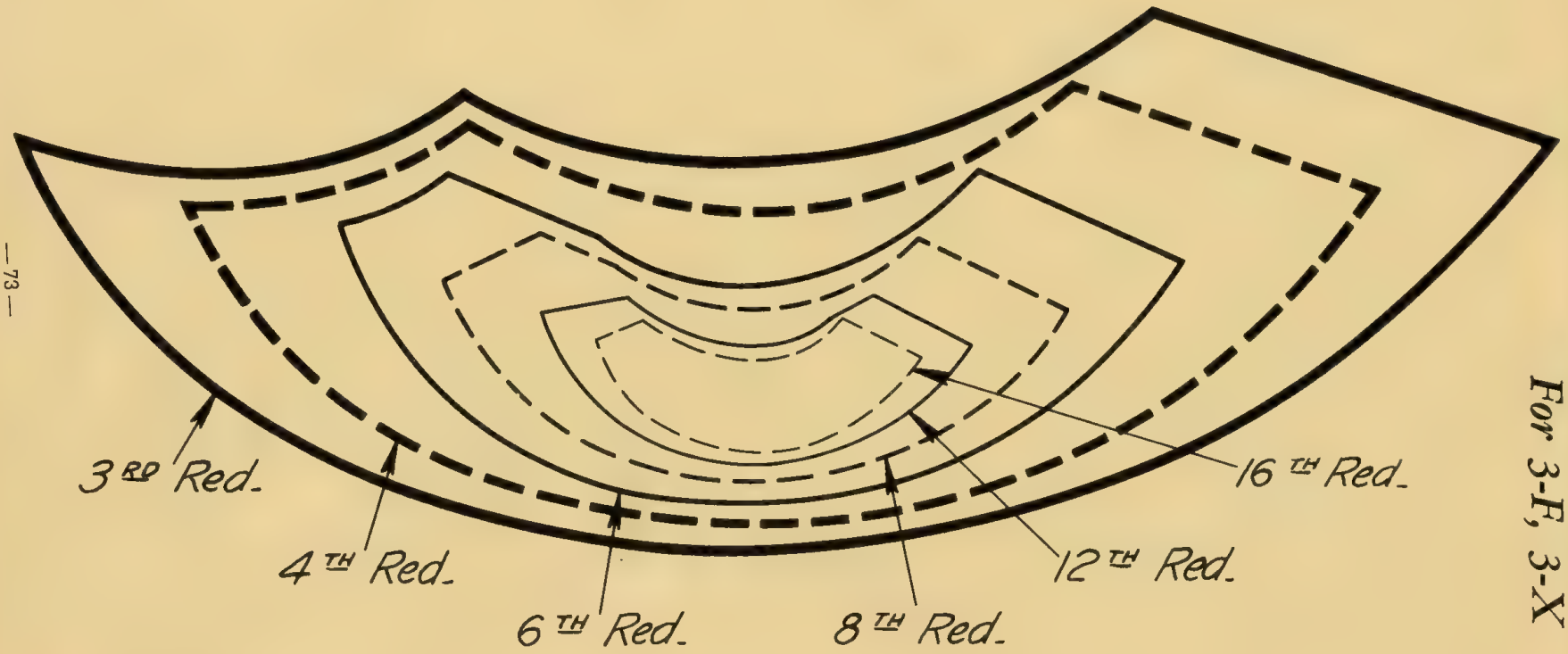
FORM 949

AREA CHART FOR GORTON PANTOGRAPH MACHINES.

(STANDARD TYPE) NO'S. 3-F, 3-X.

Showing the largest area covered with cutter point on the various reductions without resetting work or copy. Larger work can of course be reset by moving table.

This line is parallel with table & copyholder.



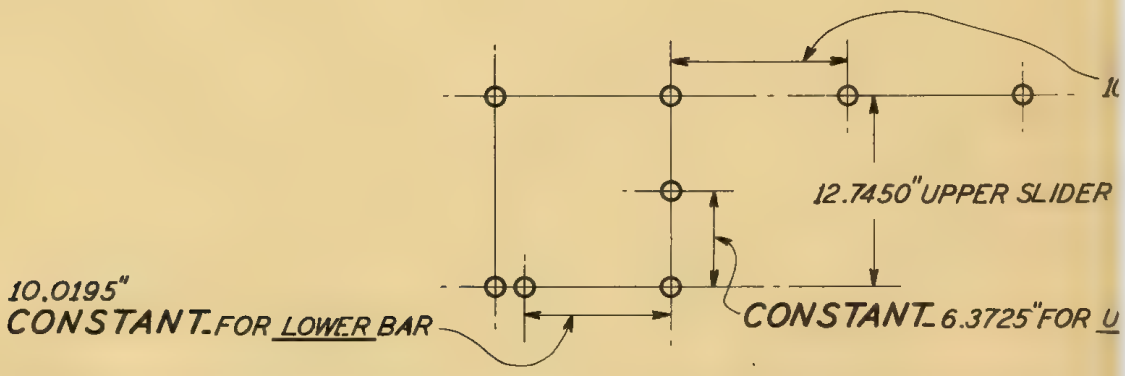
For 3-F, 3-X

DRAWING
9358

GEO. GORTON MACH. CO.
RACINE, WIS., U. S. A.

FORMULA FOR OBTAINING SPECI
REDUCTIONS FROM 1 TO 1, TO 2 T

ON ENGRAVING MACHINES, NUMBERS 3U, 3Z.



EXAMPLE: REQUIRED THE SETTINGS IN INCHES FOR REDU

FOR LOWER SLIDER BAR.

REQUIRED REDUCTION 1.5) 10.0195" / 6.679

LONG ARM CENTERS.

LOWER BAR CONSTANT 10.0195"

SUBTRACT FROM 6.679"

3.340"

DISTANCE TO SET INDEX EDGE ON LOWER SLIDER BAR HEAD FROM GRADUATION 1 & 2.

FOR UPP

FIRST DIVIDE THE UPPE
DISTANCE 12.745" BY TH
REQUIRED PLUS A CONS
1.0 U

REDUCTION REQUIRED 1.5 / 2.5) 12.7 / 5.0

SUBTRACT FROM 6.. / 5.0

DISTANCE 1..
TO SET INDEX EDGE ON
HEAD FROM GRADUATIO

SCHEDULE OF VARIOUS REDUCTIONS BETWEEN 1 TO 1 & 2 TO 1, ON NO'S. 3U & 3Z MACHINES_ WITH TRACING STYLE IN NEAREST HOLE OF PANTOGRAPH ARM_

DISTANCES GIVEN IN INCHES.

REDUCTION	DISTANCE NECESSARY TO SET INDEX EDGE ON LOWER SLIDER BAR HEAD FROM GRADUATION MARKED 1 & 2.	DISTANCE NECESSARY TO SET INDEX EDGE ON UPPER SLIDER BAR HEAD FROM GRADUATION MARKED 1.
1.0	0	0
1.1	.911"	.303"
1.2	1.670"	.579"
1.3	2.312"	.831"
1.4	2.863"	1.062"
1.5	3.340"	1.275"
1.6	3.757"	1.471"
1.7	4.126"	1.651"
1.8	4.453"	1.821"
1.9	4.746"	1.978"

TO OBTAIN ANY SPECIAL REDUCTION NOT GIVEN ABOVE, USE FORMULA.

FOR GREATER REDUCTIONS USE SCHEDULE AS PER INSTRUCTION BOOK WITH TRACING STYLE AT EXTREME END OF PANTOGRAPH ARM_

4L
01.

).0195" LONG ARM.

BAR.
PANTOGRAPH CENTERS.

PPER BAR_

CING 1.5 TO 1.

TR SLIDER BAR.

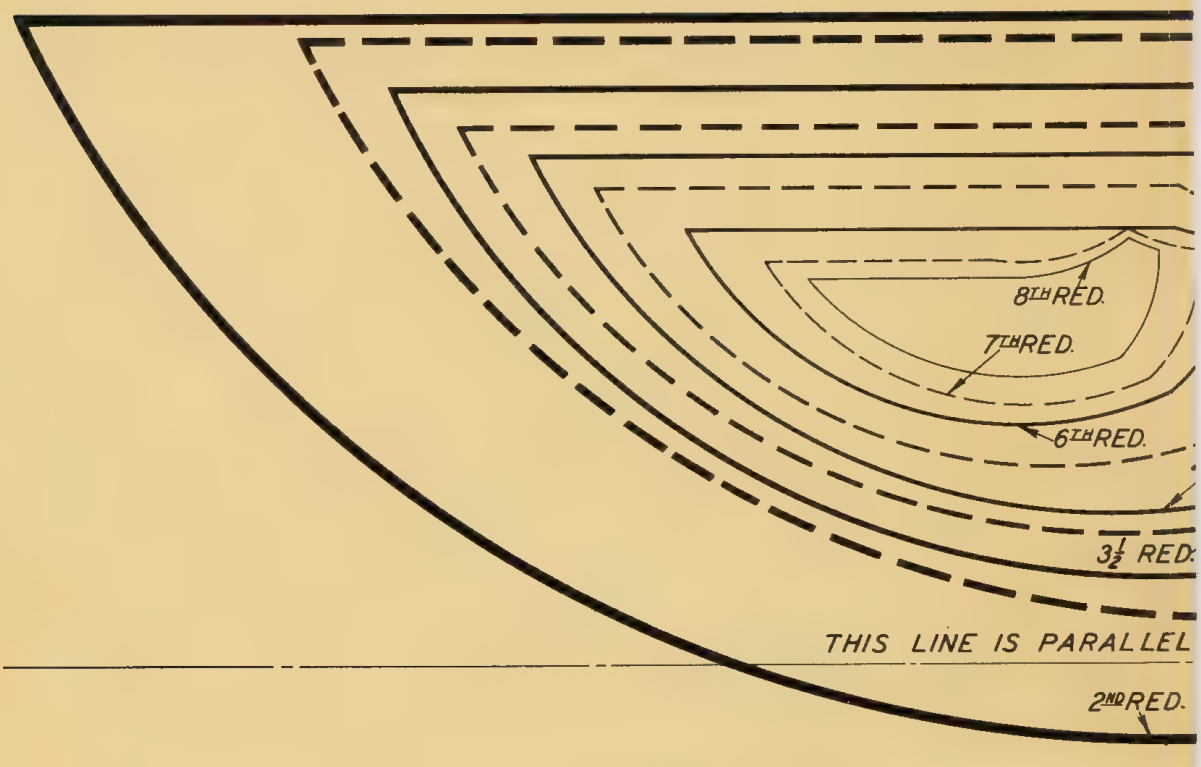
SLIDER BAR CENTER
E REDUCTION
TANT OF 1.
PPER SLIDER BAR CENTERS.

45"
98"

3725" — UPPER BAR
098" CONSTANT.
2745"
UPPER SLIDER BAR
N 1.

DRAWING 7561 1957

For 3-B



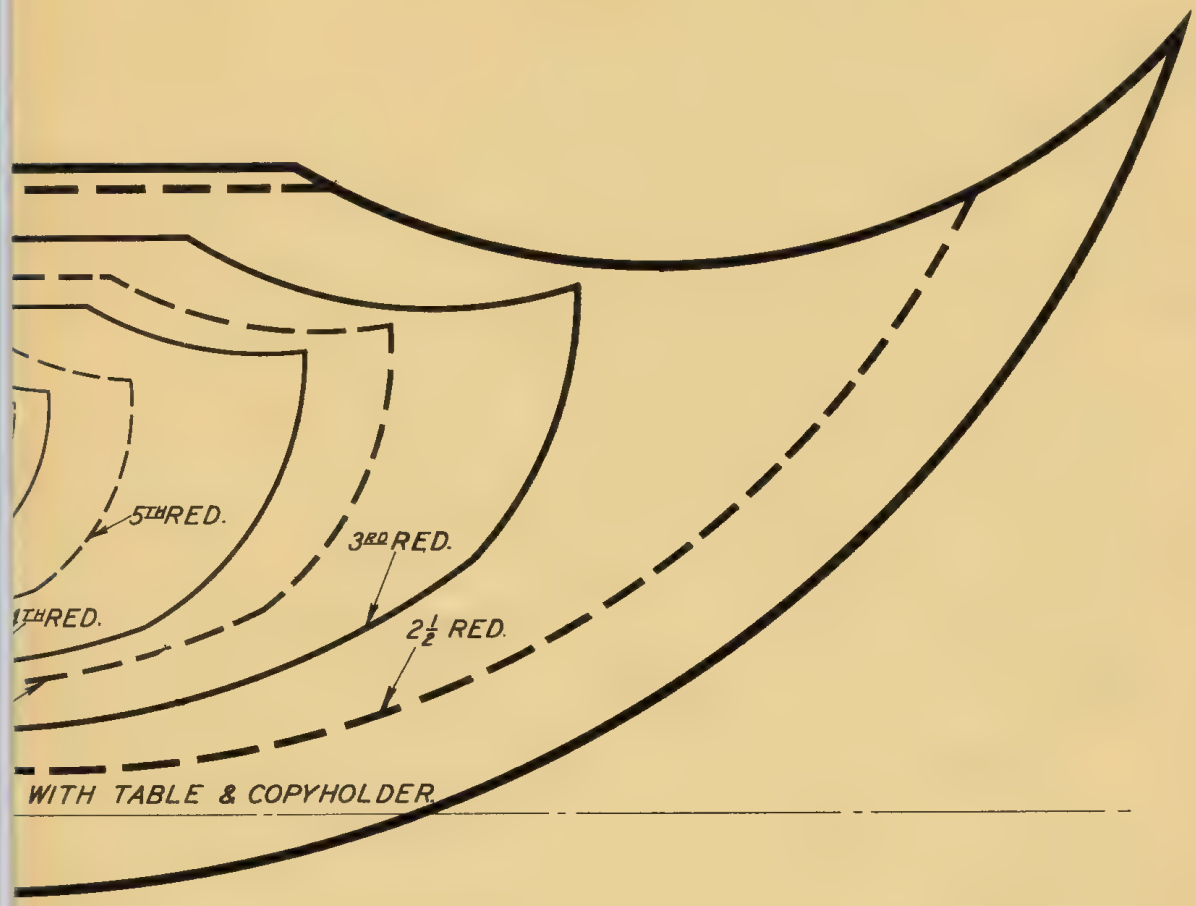
AREA CHART FOR GORTO
PANTOGRAPH MACHINE N

DRAWING
8793

SHOWING THE LARGEST AREA COVE
POINT ON THE VARIOUS REDUCTIO
WORK OR COPY. LARGER WORK CA
RESET BY MOVING TABLE.

GEORGE GORTON MA

RACINE, WISCONSIN,



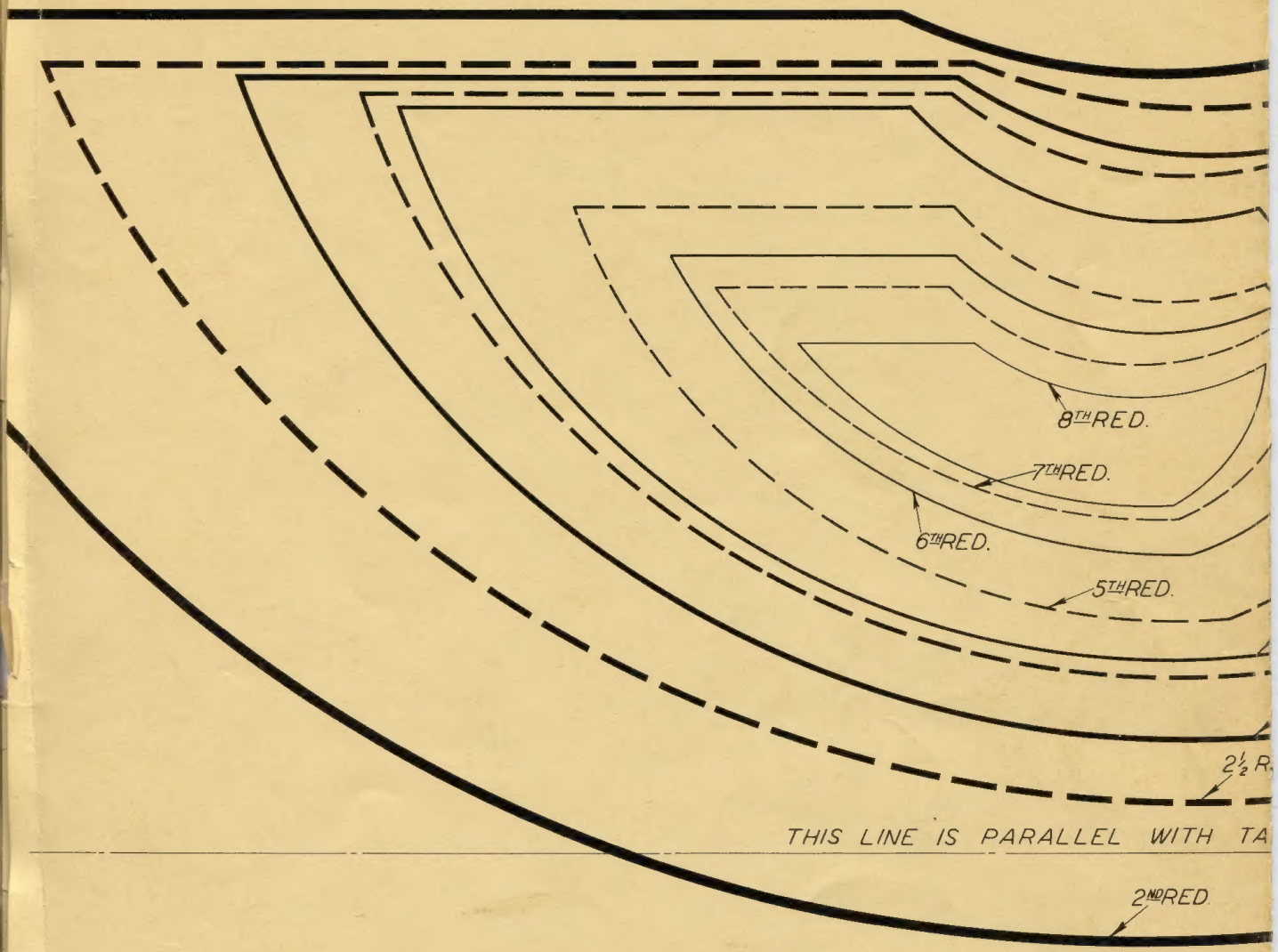
V (3-DIMENSIONAL TYPE.)
O. 3-B

RED WITH CUTTER
IS WITHOUT RESETTING
OF COURSE BE

CHINE CO.
S. A.

This Chart is Exactly Half Size

For 3-L



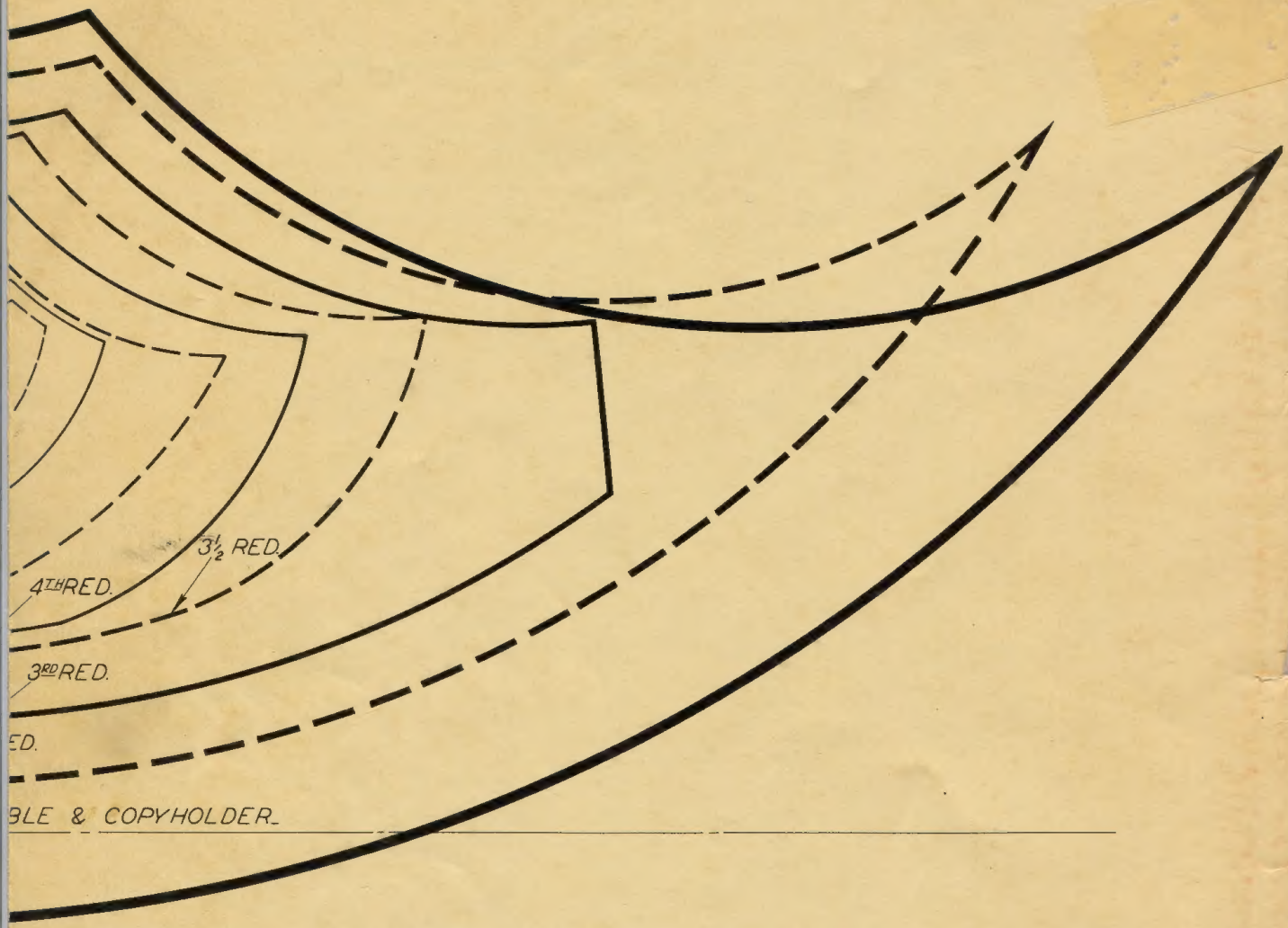
AREA CHART FOR GO
PANTOGRAPH MACHIN

SHOWING THE LARGEST AREA
POINT ON THE VARIOUS REDUC
WORK OR COPY. LARGER WORK
RESET BY MOVING TABLE.

DRAWING
9377

This Chart is Exactly Half Size

GEORGE GORTON
RACINE, WISCONSIN,



ORTON (3-DIMENSIONAL TYPE.)
E NO. 3-L

COVERED WITH CUTTER
TIONS WITHOUT RESETTING
CAN OF COURSE BE

MACHINE CO.
U. S. A.

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